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A Second Crisis Passed

THIS country has just gone through a second financial crisis, and one of even greater severity than that which led to the formation of the National Government a month ago. The strain upon the British financial machine had become so great that the Government, acting on the advice of the Bank of England, undertook the three-fold remedy of suspending the gold standard, raising the Bank Rate to six per cent., and temporarily closing the Stock Exchange. The adoption of these measures has created a situation unprecedented in the memory of the business community. It has had the immediate effect of easing the strain all round, but any forecast of its ultimate results is the purest speculation. The one thing that is absolutely certain is that this is no time either for jubilation or for panic. The situation is too serious for any manifestation of unreasoning emotion. A cool head and a fixed determination not to be rushed into extremes of thought or action are the best assets of any business house at the present time, and all the available evidence suggests that there is no weakening of these much prized attributes of the national character.

If the events of the past month are to be seen in their proper perspective an essential condition must be taken for granted. It is that these successive crises have been caused by forces completely beyond the control of every reader of this journal and of every commentator in the public press. It should be abundantly clear to everybody after the shock of last week-end that dangers gradually gaining strength from a variety of causes for several years suddenly attained a momentum that could be withstood only by the nation as a whole. The individual had become virtually powerless under the pressure of a world-wide movement, and corporate authority could alone provide the remedy. Privately held theories of the best way of putting the world right are of no avail. The best advice that can be given to the business community is to place implicit confidence in the only power that is capable of restoring the position—the Government, with its skilled advisers, the great banking authorities. They have kept control of an extraordinarily difficult situation with a wise courage that cannot be over-estimated, and they ought to be assured of the undivided support of the nation in any further measures that they think it proper to take.

The manufacturers and traders of Great Britain are not easily rattled, and they are facing the present emergency with a degree of reasoned confidence that has surprised their foreign competitors. Their demeanour has caused no surprise among their fellows at home, because it is recognised for one thing that it is grounded on a clear conception of the fundamental position of British trade. This country has been forced by the temporary suspension of gold exports to accept the inflation of its currency to the extent of ten per cent. or a little more. That is not to say that inflation will be uncontrolled as it was in several continental countries after the war, and that there will be a progressive flight from the pound sterling. The Chancellor of the Exchequer quite properly pointed to the balancing of the Budget as a factor enabling a controlling hand to be kept on the pound and on its arch-enemy the printing of paper money. At the same time, the balancing of the Budget is only a symptom of the larger consideration on which the business community instinctively relies. It cannot be disputed that the national position would have been infinitely graver if it had not been for the tremendously strong foundations on which the British trade structure rests. Those foundations were laid by previous generations, and the tradition persists with the present generation, notwithstanding the long-continued efforts of present-day politicians to weaken it. There would never have been a crisis at all if successive Governments had not departed from the strict canons of Victorian finance. The crisis will in good time be weathered because those canons are once more being accepted and acted upon, and the smash-and-grab theories of the last few years are being discarded.

What the individual trader will do is to apply to his own business in his own way the new financial expedients offered to him. A little reflection will show that the temporary suspension of the gold standard will have some of the effects of a small emergency tariff. Importing will become more difficult and exporting more easy. Commodity prices have risen at once, and past experience of inflation at this stage leaves little doubt that there will be an immediate fillip to trade all round. The business community will take every advantage of the new state of affairs, but it will not overlook the fact that the ultimate effects of this policy cannot be foreseen. The final issue from these grave troubles is not yet in sight. What, however, is assured is the will to get the nation back to its old and sounder basis of economic strength. Each man in his own business knows that he can rely on inherited skill and a renewed will to work. He can have every confidence in the future if the national affairs are wisely directed from above. He has the best guarantee of such direction in the successive acts of the National Government to whom he continues to pin his faith.

Oil Developments at Billingham

THE prospect of turning to practical account the hydrogenation processes that have been perfected at Billingham has been advanced another distinct stage this week, when large parties representative of British coal-mining interests were invited by Imperial Chemical Industries to inspect the plant and to see its products tested. Confident opinions have for some time past been expressed that under proper conditions and with adequate national support the conversion of coal into oil might become an important national industry. The advanta es of a new industry of this sort are obvious. The first would be the creation of a new home market for coal. The second is that the utilisation of home-produced petrol in considerable quantity would proportionately diminish the amount of money spent on imported oil—an important point in view of our departure from the gold standard. The third is that it would provide additional employment both at the mines and at the works, and would result in orders for home plant and machinery, for the hydrogenation plant at Billingham, we understand, is all of British manufacture. There are, therefore, the most solid reasons for hoping that the prospective enterprise may receive the necessary support from all the sources interested. The rapid advance in technique has been rendered possible by the International Hydrogenation Co., which was formed for the purpose of pooling all patents and knowledge relating to hydrogenation.

To avoid any confusion with other methods of coal carbonisation and treatment, it should be made clear that hydrogenation is only one of many methods by which it is possible to extract a certain quantity of petrol from coal. The most numerous of these processes are those covered by the description "Low Temperature Carbonisation." These treat the coal by distillation, with the result that, roughly speaking, each ton gives about ¾ ton of semi-coke, about 4 to 5 thousand cubic feet of gas, and about 18 gallons of tar, from which motor spirit can be eventually made. In other words, while the quantity of spirit obtained is small, there are a number of by-products which have to be sold profitably before the process can possibly become self-supporting. Hydrogenation has nothing whatever to do with any method of this sort. There are no final products other than oil. Although all coals are not equally suitable for hydrogenation treatment, it may roughly be assumed that each ton of coal hydrogenated can be made to give approximately 60 per cent. weight of petrol, a certain amount of gas that is used in the process, and a residue of ash which is for all practical purposes waste. Hydrogenation therefore stands on its own feet, and is not dependent upon any problematical sale of by-products for its return.

The Hydrogenation Process

THE first stage in hydrogenation is the washing of the raw pit coal; the second is the grinding of the rough slack or nuts, which are then mixed with a proportion of oil, which is in itself the product of a previous cycle of production. The coal, being now ground and mixed with oil, is injected into heavy steel vessels, where it meets hydrogen under pressure. The process is a continuous one, the time of contact in the vessels being suitably arranged, after which there issues from the vessels: (1) petrol; (2) heavier oils (Diesel, etc., which are used in the next process); (3) sludge (ash and unconverted coal); and (4) gas, the proportion of motor spirit to heavier oils being variable at will. The heavier oils are again put into the cycle of production to make more petrol, or they can be refined separately if required. The sludge, which also contains oil, has the oil recovered from it, and the latter is re-cycled, while the gas goes back and is used for making the bulk of the hydrogen used in the process.

There have been many ill-founded assumptions as to the point which the production of synthetic petrol has already reached. It is commonly assumed that the development of a synthetic petrol industry cannot be a commerical proposition for many years to come. So much progress, however, has been made with research into commercial production that even at the moment the difference between the price at which the natural petrol can be obtained by the public and that at which the synthetic article can be manufactured and could be similarly marketed is far less than is generally imagined. In fact, it would require only a very small rise on the present abnormally low price to make the manufacture of petrol from coal commercial. This takes no account of any considerations of national security which might be held to justify the development of an indigenous petrol-producing industry.

Finally, it should not be forgotten that the United Kingdom consumption of petrol alone exceeds three million tons per annum. All this is imported from abroad; and our total bill for petroleum products of all kinds is over £42 millions a year.

The Calendar

October 2	Institution of Chemical Engineers: "The Gas Generator as a Direct Producer of Metallurgical Products." N. E. Rambush and F. F. Rixon. 6 p.m.	Burlington House, London.
5	Sir John Cass Technical Institute: Inaugural Ceremony Session 1931-32. 8.15 p.m.	Jewry Street, Aldgate, London.

Faraday and the Theory of Electrolytic Conduction

By Sir Harold Hartley, F.R.S.

The following extracts are from Sir Harold Hartley's Presidential Address to the Chemistry Section of the British Association, on the occasion of their Centenary Meeting, which coincides with the Centenary of Michael Faraday's discovery of electro-magnetic induction.

THE year 1831 was the turning-point of Faraday's career. There is no greater contrast in scientific literature than his earlier chemical papers, characterised by their essentially practical outlook and accomplishment and the brilliant flights of imagination which inspired his "Experimental Researches in Electricity." Electricity was one of Faraday's earliest scientific interests. Long before he went to Davy he was experimenting with home-made batteries. Already in 1816 we get a glimpse of his intuitive belief in the essential unity of the forces of nature, which was to influence so greatly the current of his researches.

In 1821 Faraday repeated the experiments of Oersted, Arago and Ampère on electro-magnetism and discovered the rotation of a wire carrying a current if free to move round a magnetic pole. Magnetism had been produced from electricity and Faraday was convinced of the possibility of obtaining electricity from magnetism. His new discovery of magneto-electricity (1831) raised afresh in Faraday's mind the old and still disputed problem of the identity of electricities from different sources, and chemical action was one of the tests he applied to its solution. Having shown that common (frictional), voltaic, and magneto-electricity all produce similar physiological, magnetic, chemical and thermal effects, Faraday, on September 14 and 15, 1832, established quantitatively the identical nature of common and voltaic electricity by showing that such quantities of these two kinds of electricity as produced equal effects on the needle of his galvanometer, also liberated equal amounts of iodine, as judged by the intensity of the brown stain, when a piece of bibulous paper moistened with potassium iodide was placed in the circuit.

The Nature of Electrolysis

In the work that led up to these decisive results, Faraday had made many experiments on the chemical action produced by a current. In one of them he placed one end of a long piece of litmus paper moistened with sodium sulphate in contact with an electrical machine, while the other end was held opposite to the discharging points. On turning the machine Faraday saw that decomposition took place, the paper becoming red "where the positive electricity entered from the air." This proved to him that the decomposition was not dependent on the presence of metallic poles in the solution, and on September 6 he wrote in his note-book: "Hence it would seem that it is not a mere repulsion of the alkali and attraction of the acid by the positive pole, etc., etc., but that as the current of electricity passes, whether by metallic poles or not, the elementary particles arrange themselves and that the alkali goes as far as it can with the current in one direction and the acid in the other. The metallic poles used appear to be mere terminations of the decomposable substance. The effects of decomposition would seem rather to depend upon a relief of the chemical affinity in one direction and an exaltation of it on the other, rather than to direct attraction and repulsions of the poles." Here we see the germ of Faraday's ideas on the nature of electrolysis.

This led Faraday to examine the conductivity in the fused state of a number of substances which are solid at ordinary temperatures, and to study the products formed during electrolysis. It was a new field for him and he showed his usual experimental skill in devising simple methods for working at high temperatures, including even the use of the oxy-hydrogen blowpipe. He found that a number of substances resembled water in being insulators in the solid state and becoming good conductors if fused, when they were decomposed by the current, but that this phenomenon was by no means universal. He thus arrived at no general conclusion, but the experience he gained in working with fused salts was to prove invaluable later in the year in his work on electro-chemical equivalents. The experiments were finished on April 22, and on April 24 they were communicated to the Royal Society with the title, "On a New Law of Electric Conduction."

Faraday then turned his attention to the mechanism of conduction in a liquid. On May 2 he passes a strong current through a saturated solution of sodium sulphate and examines it with polarised light both across and along the direction of the current to see if he can detect signs of arrangement of the molecules, but without result. On May 20 he determines the transfer of sulphuric acid during electrolysis by measuring the changes in concentration in two vessels connected by moist asbestos. He summed up his views in a paper to the Royal Society on June 18, the main conclusion being "that electro-chemical decomposition does not depend on the simultaneous action of two metallic poles," and the effects of it "are due to a modification, by the electric current, of the chemical affinity of the particles through or by which that current is passing, giving them the power of acting more forcibly in one direction than in another, and consequently making them travel by a series of successive decompositions and recompositions in opposite directions, and finally causing their expulsion or exclusion at the boundaries of the body under decomposition."

Faraday's Laws of Electrolysis

Faraday returned to the investigation of the amount of chemical action produced by the current, and as he recognised that in the electrolysis of aqueous solutions it was doubtful whether the elements liberated at the poles were to be regarded as primary or secondary products, he extended the inquiry to include fused substances, which would be free from this ambiguity. On December 17 he wrote in his note-book: "Proceeded to decompose dry chlorides, oxides, etc., to ascertain if there also the decomposition was definite and what the equivalent numbers would be." So quickly was the final stage in the investigation accomplished that on January 9, 1834, the paper containing the Laws of Electrolysis was communicated to the Royal Society. In the first experiment, on December 17, fused stannous chloride in a glass tube was decomposed with platinum wire poles with a voltameter in series, and the weight of the tin liberated compared with the weight of water decomposed in the voltameter.

Similar experiments continued all through December, with a holiday on Christmas Day. Fused lead chloride, lead borate, and lead iodide gave confirmatory evidence, but the work was difficult and often gave inconclusive results. Faraday was anxious to extend it to the deposition of metals from aqueous solutions, and he found that zinc deposited on a platinum electrode gave an electro-chemical equivalent of 34·08, while the loss in weight of amalgamated zinc in contact with platinum compared with the weight of hydrogen evolved gave in two experiments equivalents of 30·2 and 32·31. These researches had strengthened enormously the evidence for his First Law of Electrolysis—"The chemical power of a current of electricity is in direct proportion to the absolute quantity of electricity which passes"—and they had established the Second Law—"Electro-chemical equivalents coincide, and are the same with ordinary chemical equivalents."

This paper was the most important of Faraday's contributions to electro-chemistry, and in it he summarises all his previous work. He begins by introducing the new terminology which he devised with the help of Whewell, for the sake of greater precision of expression, and all his new names—electrode, anode, cathode, ion, anion, and cation, electrolyte and electrolysis—we use to-day with the significance which Faraday gave to them. After a short account of the conditions necessary for electro-chemical decomposition, he describes his new volta-electrometer and the evidence that led him to the conclusion that the amount of chemical action is dependent solely on the amount of electricity that passes through it. He next discusses whether the products of electrolysis are primary or secondary, and gives his evidence for the identity of chemical and electro-chemical equivalents. He goes on to consider the absolute quantity of electricity associated with the particles or atoms of matter, pointing out how enormous this must be since 800,000 charges of a Leyden battery "would be necessary to supply electricity sufficient to decompose a single grain of water."

Chemical Action in the Production of Electricity

On January 18, 1834, Faraday made some experiments, when Daniell was present, on the number of cells necessary to electrolyse sulphuric acid, which showed him "that the number of decompositions which, on the one hand, excite or produce the current and, on the other, retard it constitute the essential point." For three weeks he tried to isolate fluorine, and on February 10 thought he had obtained it by the electrolysis of fused lead fluoride. On April 7, less than two months later, his paper "On the Electricity of the Voltaic Pile" reached the Royal Society. In it he presents fresh experimental evidence for the chemical theory of the voltaic cell, including a direct proof that a current may flow when there is no direct contact between the two metals, a slip of paper moistened with potassium iodide being interposed between them. It is clear from his note-book that his mind was concentrated on the relation between chemical action and the production of electricity, and he quickly realised that whether a current passes or not depends on the relative magnitudes of the chemical affinities of the reactions taking place in the battery and in the electrolytic cells. Faraday saw that a chemical reaction can be carried out in two ways, either by means of a voltaic cell in which the reactants are separated by an electrolyte, or by their direct contact, and further, he identified the electromotive force of the cell with the chemical affinity of the reaction.

It is difficult for us to-day to realise the effect of Faraday's work on the progress of electro-chemistry, the clarity of ideas which came from his new nomenclature, the quantitative treatment of the problems which was made possible by his Laws of Electrolysis, the significance of his distinction between quantity of electricity and its intensity or potential, and his association of these two electrical quantities with the magnitude of the chemical change and of the chemical affinity respectively. Naturally, with so vast and complex a subject, so little understood, even Faraday made mistakes. He thought that in aqueous solutions hydrogen and oxygen were the ions that carried the current, other ions only appearing at the electrodes by secondary action, although in fused salts he knew that these secondary products acted as ions in his own sense of the word. Then, he supposed that only compounds containing one atom of each element could act as electrolytes, and he made rash statements about the existence of a binary oxide and sulphide of antimony. He thought, too, that an element could have only one electro-chemical equivalent, neglecting the different degrees of oxidation of metals. And he assumed that electrolytes possessed a certain measure of metallic conductivity subsidiary to their electrolytic conduction.

During the century that has elapsed since Faraday's discoveries, the conduction of electricity in solutions has remained one of the central problems of chemistry and physics. The direct successor to Faraday was Daniell, who studied in detail the changes in the concentration of electrolytes at the electrodes produced by electrolysis, which had first been observed by Faraday. His papers were published in three letters to Faraday in 1840–44, and their most important result was to show that the current in aqueous solutions is actually carried by the ions of the solute and not, as Faraday had supposed, by the ions of hydrogen and oxygen. Ten years later this aspect of electrolysis was the subject of a classical investigation by Hittorf on "The Migration of Ions during Electrolysis," which was of the greatest significance for the theory of solutions. Hittorf realised that the changes in concentration round the electrodes could only be explained on the assumption that the ions move with different velocities, and he showed how their relative speeds could be calculated from the change in concentration, a very remarkable achievement in 1853. Simultaneously, with the work on transference, a number of observers like Wheatstone, Wiedemann, and Beetz, were also studying the conductivity of solutions in the light of Ohm's Law.

The Ionic Theory

The next phase is almost too well-known to need recalling. In 1883 Arrhenius, working on dilute aqueous solutions, concluded that the equivalent conductivity increases with dilution because the proportion of conducting molecules increases. He then found a correspondence between the conductivities of acids and their strength as determined thermochemically by Berthelot, or by the method of displacement. This suggested to him that the molecules which are active as regards conductivity are active chemically, and it occured to him that these active molecules are dissociated, since this would explain why the heats of neutralisation of all strong acids and bases are the same. He communicated this idea to Ostwald, who was then working on the catalytic activity of different acids, and they found that the catalytic activities of these acids was roughly proportional to their conductivities.

On its publication in 1887, the ionic theory met with violent opposition, but, in the hands of Arrhenius, Ostwald, van't Hoff and Nernst, its value was quickly established in the most varied fields: the theory of concentration cells and of liquid junction potentials, the behaviour of weak acids and bases and the hydrolysis of salts, the properties of indicators, the dissociation of water, and the theory of qualitative and quantitative analysis. Entirely fresh light was thrown on all these problems, and in many instances they admitted of quantitiative explanation for the first time. Then the connection between electricity and chemical affinity, which chemists had been seeking since the days of Berzelius and Faraday, suddenly became clear, and we learnt the cause of ionisation and of the stability of ions in solution. Metallic sodium reacts with water in order to give up an electron; the sodium ion having already lost an electron, is no longer reactive. Faraday had often drawn attention to "the enormous electric power of each particle or atom of matter," i.e., the large size of the ionic charge. Helmholtz, in 1881, in his Faraday lecture, made a calculation showing that the attractive force between the electrical charges associated with hydrogen and oxygen is 71,000 billion times greater than the gravitational attraction between their masses. It would seem obvious that forces such as these must affect the behaviour of ions, and from time to time suggestions came from chemists that strong electrolytes were completely dissociated, and that the variations of equivalent conductivity with concentration were due not to a change in the degree of dissociation, but to the varying effect of the interionic forces.

Influence of Solvent on Electrolyte

The influence of the solvent on the properties of an electrolyte is illustrated very clearly by a comparision of the behaviour of uni-univalent salts in water and in non-aqueous solvents. In water they are all strong electrolytes with surprisingly uniform behaviour, as shown by Kohlrausch in *Zeitschrift für Electrochemie*, 1907. In non-aqueous solvents however, Walden's comprehensive investigations have shown that individual differences begin to appear as the interionic forces increase and the specific affinities of the ions are brought to light. The question naturally arises as to whether the extent of the ionic association is determined entirely by the interionic forces, i.e., by the dielectric constant of the solvent. This is clearly not the case, since a number of salts are strong electrolytes in methyl alcohol and weak electrolytes in nitromethane, which has a higher dielectric constant (37 as against 30·3). Walden and Ulich have pointed out that, in general, non-hydroxylic solvents, such as the nitro-compounds and acetone, accentuate the individual differences between electrolytes, while the hydroxylic solvents suppress them. The reason for this is probably to be found in a difference in the nature of the solvation of the ions in the two classes of solvents. There is abundant evidence that the ions in solution have a number of solvent molecules attached to them either by co-ordinate linkages or as a result if the dipole character of the solvent, and these solvent atmospheres exert an important influence on the behaviour of the ions.

Sidgwick has considered solvation from the electronic standpoint, and has emphasised the importance of the donor and acceptor properties of hydroxylic solvents in enabling them to form co-ordinate links with both anions and kations. Non-hydroxylic solvents, however, like nitromethane and acetone, can only form co-ordinate links with kations, leaving the anions chemically unsolvated, and it is very significant that in such solvents lithium salts are weak electrolytes, while in hydroxylic solvents they are less associated than the salts of the other alkali metals. It would thus appear that the existence of a chemical link between the solvent molecules and both ions is of cardinal importance in preventing ionic association. This view of the protective action of hydroxylic solvent molecules is confirmed by the effects of small quantities of water on the conductivity of solutions in nitromethane and other non-hydroxylic solvents. For example, the conductivity

of lithium thiocyanate, a weak salt, is increased 60 per cent. by the addition of 0·1 per cent. of water, while that of tetra-ethyl-ammonium iodide, a strong electrolyte, is only increased 0·22 per cent. by a similar addition.

The Task of the Immediate Future

Until recently most of our ideas about electrolytic solutions were based on experience in water, and this gave quite a false impression of the simplicity of the problem, since in water, thanks to its high dielectric constant and to the protection afforded by the chemical solvation of both ions, all univalent salts exhibit almost ideal behaviour. But a survey of non-aqueous solutions reveals at once a much more complex situation, in which the chemical nature of the solvent and the affinities of the ions are often the predominant factors. Looking back over the century, we see how the mechanism of electrolytic conduction has gradually been disclosed to us, and how in recent years the many-sided influence of the solvent has come more and more into prominence. By its dielectric constant the solvent determines the magnitude of the interionic forces. By its power of solvating the ions it exerts a decisive influence on the extent to which they form ion pairs or undissociated molecules. And lastly by its viscosity, as well as by the extent of solvation, it determines the mobilities of the ions. The task of the immediate future is to discover the precise nature and extent of the solvent atmosphere around the ions which exerts such an important influence on their properties.

The Chemistry of the Vitamins

Noteworthy Advances of the Past Year

The chemistry of the Vitamins and related substances was the chief feature of the Chemistry Section of the British Association on Friday, September 25. This discussion was introduced by Sir F. Gowland Hopkins, President of the Royal Society, to whom we owe the discovery of these all-important dietary factors. Extracts from some of the papers presented are given below.

THE carotinoids, according to Professor P. Karrer, in his paper on the chemical constitution of carotene and related substances, are a group of yellow pigments, which occur in plants as well as in animals. A considerable number of double linkages characterises their chemical constitution. At present we know ten basic substances belonging to this group, and of these ten, two, Lycopene and Carotene, are hydrocarbons, having the composition $C_{40}H_{56}$.

Two ways have proved particularly helpful in elucidating their constitution; catalytical hydrogenation, which gives the number of double linkages in the molecule, and degradation by oxidation, with ozone, potassium permanganate or chromic acid. Oxidation breaks up the large molecule, and from the fragments an insight is gained into the structure of the carbon chain.

Lycopene, the pigment of the tomato, has thirteen double linkages, and is therefore an entirely aliphatic compound, with an open carbon chain. Carotene occurs in two modifications, designated as α- and β-carotene. Of the two isomeric forms the α-modification shows a high degree of optical activity; the β-carotene is optically inactive. The two modifications have a different melting point and also differ in their absorption spectra. Both carotenes have eleven double linkages and two carbon rings. The isomerism is brought about by a different arrangement of the double linkages. Partial hydrogenation of the carotenes leads to the di-hydrocarotenes. Vitamin A from cod-liver oil is not identical with carotene. Highly active vitamin A preparations give upon ozonization, just like carotene, geronic acid. The vitamin A of cod liver oil must therefore contain in its molecule the same carbon ring as carotene, and in that sense could be regarded as a derivative of carotene.

Biochemical Effects of the Carotenes

In close connection with Professor Karrer's preceding paper on the chemistry of carotene and carotinoids, Professor H. von. Euler gives a summary of recent results concerning the biological and biochemical effects of the carotenes, some carotene-derivates and other growth-promoting factors. Since it was established that two forms of carotene exist in plants and that a third isomeric carotene can be regenerated from carotene tri-iodide, the growth response of these three isomers has been determined both on rats and some other animals. The transformation of the carotene isomers into other growth-promoting factors, related to the "vitamin A" of the cod-liver oil has also been studied. Experiments have been made to determine the distribution of the growth-promoting factors in live rand in blood-serum of different animals, examined at different ages and under different physiological circumstances. "Vitamin A" concentrates with an extremely high biological activity, giving a more than 100 times stronger Carr-Price reaction than carotene, have been obtained from animal oils.

Spectroscopy and Vitamin A

The paper by Professor I. M. Heilbron, F.R.S., and Dr. R. A. Morton concerned spectroscopy and Vitamin A. Fish and mammalian liver oils and concentrates, it was stated exhibit an absorption band in the ultra-violet (maximum 328μμ), the intensity of which has been found to vary over the range 1–20,000, and which can be determined to within ± 5 per cent. With antimony trichloride the same materials give a blue solution, the depth of colour extending over the range 1–60,000 at least. The blue solutions exhibit initially two absorption bands (maxima 572–583μμ, 600–620μμ), either of which may be so much more intense than the other as to make detection of the second band difficult in extreme cases. The longer wave-length band is usually the stronger, but the shorter wave-length maximum can always be detected by applying the colour test in a modified form, $\frac{1}{15}$ of the usual quantity of reagent being used 1–1½ minutes before the rest is added. This procedure depresses the 600–620μμ band without noticeably affecting the 562–583μμ band. In many instances the latter band predominates in the colour test. If an oil giving this result is exposed to the action of ozonised oxygen or hydrogen peroxide, a considerable increase in the intensity of the 600–620μμ band is usually seen when the oil is retested with antimony trichloride, but this increase is not at the expense of the 562–583μμ band. Liver oils are thus proved to contain two chromogenic substances which behave as separate entities although the evidence does not exclude kinship.

According to Professor R. Kuhn three different methods for the preparation of α-carotene have been worked out which, regardless of the source of the material, lead to products having identical absorption spectrum and optical activity. The pigment of palm-oil contains relatively the largest amount of α-carotene.

Concentration of Vitamin A

Dealing with the concentration of Vitamin A, Dr. T. Moore states that although the high vitamin A content of mammalian livers has long been realised, most serious attempts at the isolation of the vitamin have been based on the use of cod-liver oil, or some similar fish-liver oil, as the starting material. Concentrates prepared from cod liver oil are not usually effective in rat tests at doses lower than 0·01 mg., and give values of 200–400 blue units per mg. in the antimony trichloride reaction. Almost all natural mammalian liver oils are richer sources of the vitamin than cod liver oil, although this superiority may be set off against the much smaller amount of oil present per unit of liver. The mammal offers an additional advantage in being amenable to artificial feeding before treatment of the liver, by which means the vitamin A content may be raised to very high levels. The capacity of the animal for absorbing reserves of vitamin A has been found to be extremely high, the limit reached being about 100,000 B.U. for the entire liver, or about a century's supply assuming utilisation at a rate equal to the minimal curative dose. The individual liver oils sometimes gave colour values as high as 600 B.U. per mg. After saponification and the removal of crystalline matter concentrates were obtained having values of 2,000 B.U. per mg. in the case of the rats fed with red palm oil, or 1,200 B.U. per mg. in the rats fed with cod liver oil.

Extraction of Vitamin B from Rice-Polishings

In his paper on Vitamin B Professor B. C. P. Jansen described the method by which Dr. Donath and he isolated the anti-neuritic B_1 vitamin. One hundred kg. of rice-polishings were extracted by water; the dissolved vitamin is adsorbed by 3 kg. of acid clay; from this it is eluted by baryta. This solution is acidified and successively treated by silver nitrate and baryta, by phosphotungstic-acid and, in alcoholic solution by an alcoholic solution of platinum-chloride. After decomposing the platinum-precipitate the solution in absolute alcohol is fractionately precipitated by acetone; after several fractionations 30 milligrams of pure B_1-vitamin-hydrochloride were obtained, whereas 100 kg. of rice-polishings contain about $1\frac{1}{2}$ gram of B_1 vitamin. Phosphotungstic-acid was ultimately substituted by the more specific silico-tungstic-acid but fractionating with silico-tungstic-acid gave a much better output. According to Drummond the decomposed platinum-salt may be further purified by gold-chloride. Seydell and van Veen remove many impurities by benzoylation.

Crystalline Preparations of Vitamin D

Mr. R. B. Bourdillon dealing with crystalline preparations of Vitamin D, said that attempts to isolate a crystalline vitamin D from the resinous mixtures obtained by the ultra-violet irradiation of ergosterol have now been partially successful in three different countries. In England a group of workers at the National Institute for Medical Research have obtained a crystalline product of m.p. 124° C., by vacuum distillation of irradiation products of ergosterol, in a still designed to secure fractional condensation of the vapours. This product appears to form esters, and to be an isomeride of ergosterol. In Germany, Professor Windaus has removed some of the irradiation products of ergosterol by condensation with maleic anhydride, and has obtained from the residues a crystalline product somewhat similar to the English one, but showing an appreciably lower specific rotation. In Holland, Drs. Reerink and van Wijk have obtained a crystalline product by irradiating ergosterol under very carefully controlled conditions. The physical properties of this product have not yet been fully described, but it appears to be more easily oxidised, and to have lower detro-rotation than the other two crystalline products. It is suggested that all three products may be mixtures in different proportions of two nearly isomorphic antirachitic compounds, one showing a high dextrorotation and considerable stability, and the other less stable and with laevorotation or low dextrorotation.

Professor A. Windaus ultimately spoke of the physical and chemical properties of ergosterol, with especial reference to its behaviour on hydrogenation, dehydrogenation and oxidation. The formation of the isomers of ergosterol under various conditions included the action of hydrogen chloride upon ergosterol, the treatment of ergosterol with finely-divided nickel, and the effect of heating the sterol with sodium ethoxide at 200°. Isomerisation of ergosterol can also be brought about by the action of ultra-violet light, whereby a number of compounds are formed; of these at least one possesses outstanding importance in virtue of its being the antirachit vitamin.

Trade with the United States

A CONFIDENTIAL memorandum on methods of trading with the United States of America, prepared by the Commercial Secretary to His Majesty's Embassy at Washington, has been received by the Department of Overseas Trade and is being issued to firms whose names are entered upon its Special Register. British firms desirous of obtaining a copy of this memorandum, together with particulars of the Special Register, should apply to the Department, 35, Old Queen Street, London, S.W.1, quoting reference number C.X. 3647.

New Source of Sugar Supply

As the result of experiments carried out by Mr. W. J. Hule, Director of Organic Chemical Research at the Dow Chemical Co., Canada, it has been discovered that the Jerusalem artichoke is a source of a sweeter sugar than is yielded by either sugar beet or cane. It is considered likely that farmers in Ireland will take up the growing of these artichokes after further experiments have been carried out, as they will grow in almost any soil, whilst the leaves make good feed for horses.

Production of Oil from Coal

Mine Owners Inspect Billingham Plant

DURING the course of this week over 150 representatives of the Mining Association have visited the Billingham works of Imperial Chemical Industries to inspect the hydrogenation plant which is working there, converting 15 tons of coal into petrol per day. This will be the first time that representatives of the coal owners have had the opportunity of judging for themselves the possibilities of the hydrogenation process as developed at Billingham. Indeed, it will be the first time that the plant has been shown to any large number of people, as hitherto the strictest secrecy has been preserved and only a few accredited experts have been allowed to see it. This explains the fact that there has been so much ignorance regarding the claims made for the process by those who have been in touch with the developments during the last two years.

The guests were received on behalf of the company by Dr. Slade, Captain Cowap and Mr. Gordon, director in charge of coal research at Billingham. The procedure followed was for the party to be given a short lecture on the theory and practice of the coal hydrogenation process. It was explained to them how 1 ton of coal upon treatment yields 62 per cent. by weight of petrol, a second ton of coal being necessary to drive the machinery of the plant and to provide the necessary heating, the overall coal requirement being about $3\frac{1}{2}$ tons of coal per ton of petrol. They were then shown the model of a plant designed to produce 200,000 tons per year of petrol, the estimated cost of this plant being between £7,000,000 and £8,000,000, whilst capable of producing petrol at 7d. per gallon.

The visitors were then shown round the laboratories where there are in operation two continuous plants treating about 2 cwt. of coal per day, each determining the best conditions for particular coals; and two other hydrogenation plants in which the oils heavier than petrol, produced in the primary treatment of coal, are hydrogenated to give a further yield of petrol. These small plants are in continuous operation and give very accurate results. In addition, the chemical laboratories and various other small experimental apparatus, the distillation columns in which the products are worked up and the ammonia plant (where very large quantities of compressed hydrogen are made for ammonia manufacture) were open for inspection.

After lunch the visitors were taken to see the full-scale experimental coal-oil plant in which 15 tons a day of coal is processed to give about 10 tons per day of mixed oils. This plant works continuously and is operating with great smoothness. After inspecting the hydrogenation plant itself, the visitors were shown the refinery where the products are worked up into first-class quality petrol, and those of them who arrived in their own cars drove away with their tanks full of Billingham petrol.

British Chemical and Dyestuffs Traders

Payments in Foreign Currencies

AT a meeting of the Executive Council of the British Chemical and Dyestuffs Traders' Association held on Tuesday, attention was drawn to the fact that certain foreign suppliers had been seeking to obtain payment for goods in currencies other than sterling.

This Council recommends to all members, both on national and on business grounds, that as far as possible such demands on the part of foreign suppliers should be resisted, and that all members should make every effort to conclude their bargains in sterling currency.

The Council has, moreover, very carefully discussed the present situation, and whilst it is considered that no useful definite action can be taken at the moment, developments will be noted and members' interests carefully watched.

Formaldehyde

The Association has been successful in arranging with the Mersey Docks and Harbour Board for future consignments of "Formaldehyde, 40 per cent. volume" to be charged with the Dock Rates and Town Dues applicable to disinfecting fluid, thus effecting a substantial economy. Members who can bring forward other instances of goods improperly classified are invited to communicate the particulars to the Association, when every effort will be made to obtain a proper rating.

The Faraday Exhibition

Royal Albert Hall, London, September 23-October 3

THE Faraday Exhibition at the Royal Albert Hall was opened by the Rt. Hon. J. C. Smuts, F.R.S., on Wednesday, September 23. It will remain open until October 3.

This exhibition forms the central feature of the celebrations in connection with the Faraday Centenary. In the words of General Smuts, " it serves no propaganda or publicity purpose ; it is simply and solely an act of homage to Michael Faraday, the man and the scientist. His statue occupies the centre of the arena, and round it are grouped many interesting relics and mementoes of Faraday the man. Radiating from this centre you see eight sections ; the tables at the narrow inner ends carry reproductions of the fundamental chemical and electrical experiments in which the most pregnant of Faraday's classic discoveries had their origin or their verification. In some of the demonstrations the actual apparatus of Faraday will be used. Then, as the segments expand towards the circumference, you find illustrations of the practical results of his fundamental discoveries ; you see the triumphs of modern sciences which have done so much to create the social, industrial, and commercial world in which we live to-day. Light, power, transport, and instantaneous world-wide communications are all illustrated here, as part of the harvest which mankind has reaped from the labours of Faraday. These applications Faraday left mostly to others and to time ; with the pride of the born creator he was most deeply interested in fundamental research. His achievement in pure science is in many ways even more significant than these practical applications, immense as they have been.

" Faraday was probably the greatest experimenter in the history of science. But the wonderful thing about him is not only his rare skill and resourcefulness and success as an experimenter, but also his scientific insight, his sureness of intuition, and his prophetic anticipation of later developments. His was an uncanny power of scientific imagination, I had almost said of scientific divination, which has put him in the very front rank of scientific genius. Not infrequently the labours and discoveries of great scientists lie off the true line of advance, and consequently lack the quality of suggestiveness and fruitfulness which are the hallmark of true genius. The great creators of science, as in other departments of life, are those whose work is dictated by a true conception of the nature of their science, and who therefore follow the predestined route along which alone it can advance in future."

Early Chemical Discoveries

Stand F is devoted to Faraday's researches in chemistry, and has been arranged by the Royal Institution. Exhibited here are samples of perchloride of carbon (hexachlorœthane, C_2Cl_6) discovered by Faraday in 1821 ; protochloride of carbon (tetrachlorœthylene, C_2Cl_4), also discovered by Faraday; a model of the tube used by Faraday for the preparation and purification of protochloride of carbon ; condensate from compressed oil-gas, similar to the material in which Faraday discovered bicarburet of hydrogen (benzene) ; distillation apparatus as used by Faraday ; the Bramah press actually used by Faraday to purify benzene ; Ure's Eudiometer used for the analysis of volatile organic substances ; and extracts from Faraday's diary giving the determination of the specific gravity, vapour density and analysis of benzene. Faraday's apparatus for the liquefaction of gases at low temperatures is also shown.

Faraday's earliest scientific work was mainly in chemistry, which he enriched by discoveries of the first importance. Under Sir Humphry Davy and Professor Brande he acquired remarkable skill in manipulating simple chemical appliances and an extraordinary faculty of drawing correct deductions from his experiments. The former is revealed by his book on Chemical Manipulations, the first edition of which appeared in 1827. The fact that chlorine, previously known as oxymuriatic gas, was an element had been discovered and proved by Davy ; but in 1821 no compound was known that contained only chlorine and carbon. Faraday prepared two such compounds and discovered a third, hexachlorobenzene, in a material sent him from abroad. The two he made were obtained by the combination of olefiant gas (ethylene) and chlorine under the influence of sunlight, a method of inducing chemical change which was almost, if not quite, novel. Olefiant gas and chlorine were first combined together in equal volumes to form " chloric ether " or Dutch liquid. This was done by admitting them alternately into a glass globe, as demonstrated. More chlorine was then admitted, some water was introduced to absorb the hydrogen chloride formed, and the globe was exposed to sunlight, or diffused daylight. A crystalline solid was thus obtained, and it was purified by sublimation and washing.

Liquefaction of Gases

Faraday noticed that on heating his perchloride was partially decomposed. By passing the vapour through a considerable length of tube filled with broken rock crystal and heated to bright redness he made the change almost complete. The product was condensed in the further part of the tube which was bent into zig-zag form, and was then purified by distillation in the same tube. He established the composition of both the chlorides of carbon by analysis and obtained very accurate results. For the determination of the chlorine he tried several methods but found that the most consistent figures were obtained by passing the vapour over red-hot baryta in a glass tube. The baryta was afterwards dissolved in nitric acid and the chlorine was precipitated by nitrate of silver and the chloride of silver was dried and weighed. The carbon was determined both by explosion with oxygen and by combustion with copper oxide. The composition of the perchloride was also ascertained by measuring the volumes of olefiant gas and chlorine from which it was formed and the volume of muriatic acid gas set free.

In 1823 Faraday analysed the crystals formed when chlorine is dissolved in ice water and found they were the hydrate of chlorine with the composition Cl_210H_2O. He then sealed up some of these crystals in an inverted V-shaped tube. On warming the arm containing the substance he observed that chlorine was given off and became condensed in the empty arm. The hydrate had decomposed and the evolved chlorine had been liquefied by the pressure set up during its liberation. This novel device for liquefying gases he promptly applied to a number of other substances, and succeeded in liquefying sulphur dioxide, hydrogen sulphide, carbon dioxide, chlorine dioxide, nitrous oxide, cyanogen, ammonia and hydrogen chloride. Samples of these made by Faraday are shown on Stand A. The exhibit on Stand F shows Faraday's method as he applied it to the liquefaction of ammonia ; the substance heated is the compound of ammonia with silver chloride, which he himself had investigated in 1818. By means of a gauge enclosed in the tube he found that the vapour pressure of ammonia at 50° F. was 6·5 atmospheres. When the silver chloride cools down it reabsorbs the ammonia and meanwhile the liquid that remains becomes very cold.

Alloy Irons and Steels

The first systematic researches on the alloying of other metals with iron and steel were carried out by Faraday 1819–1824. The exhibits on Stand S, arranged by the Chemical Sub-Committee of the Federal Council for Chemistry, represent some of the principal developments in the history of alloy steels commencing with Faraday, including examples of the remarkable variety of useful properties now obtained in ferrous alloys and their applications in industry. That Faraday was the pioneer in alloy steels is not so well known as his achievements in electricity and pure chemistry. He was, however, the first to engage, in collaboration with Stodart, in the systematic investigation of the influence of various metals alloyed with iron. The original razor and the miniature knives recently produced from Faraday's platinum steel in Hadfield's Research are shown, the actual specimens made by Faraday being exhibited on Stand E. These comprise the important exhibits of the seventy-nine steel specimens preserved by Faraday in a plain deal box and lent by the Royal Institution ; also those lent by the Science Museum and Mr. A. Evelyn Barnard. Faraday's work on alloy steels was considerably in advance of his time, and it was not until

1868 that Mushet cast his first ingot of self hardening steel, which is also exhibited.

Faraday investigated the effect of nickel up to ten per cent. with and without the addition of precious metals. High nickel iron alloys have since been exhaustively investigated, and among their valuable properties is the retention of toughness at liquid air temperatures, the subject of a very extensive research by Dewar and Hadfield in 1904. This property finds a useful application in components of plant for the liquefication of gases (Stand T). The addition of 6 or 7 per cent. of tungsten to a steel containing about 0·6 per cent. of carbon improves materially the coercive force and remanence in the hardened condition. On account of the relative cheapness of the steel it is the one most employed in the construction of magnetos, as illustrated in this exhibit. The addition of 14 to 22 per cent. of tungsten, or even more, endows the steel with the property of retaining an appreciable amount of hardness at a red heat, and consequently tools made from it can be worked at much higher speeds than those made from ordinary carbon steel.

Manganese Steel

The addition of manganese as an alloying element to produce alloy steel on a manufacturing scale, was not developed until Hadfield's systematic researches were published in 1882–1883. These resulted in the discovery by him of manganese steel, now produced on such a large scale in many countries. The original ingot of manganese steel is exhibited having properties which, as regards the effect of heat treatment, are the inverse of steels previously known, and when quenched in water from a highly heated condition becomes exceedingly tough instead of hard and brittle. In its normal water-toughened condition as used, this steel is non-magnetic, though containing about 12 per cent. of manganese and 1¼ per cent. of carbon. Its great durability combined with toughness are its striking qualities; it has a tenacity of no less than sixty to seventy tons per square inch with fifty per cent. elongation on eight inches. A number of specimens are also shown illustrating the properties of this alloy, and its use for a variety of industrial purposes, where toughness and strength are of special importance, such as: colliery wheels, bulletproof helmets and shields, crusher jaws and parts for dredgers. None of Faraday's steels so far investigated have been found to contain over about 0·33 per cent. of silicon, but the discovery of silicon steel enabled a great improvement to be effected in transformer core material, constituting a further advance in the industry inaugurated by Faraday's original pioneer work. The original ingot of this steel made by Hadfield is exhibited.

A special section of Stand S is also devoted to exhibits relating to Faraday's discovery of benzene in 1825. Seven years earlier he had begun to take an interest in oil-gas, probably as a consultant. Oil gas was a portable gas made in the early days of gas lighting, by decomposing whale oil at a red heat; the gas, under pressure, being stored in iron cylinders. Faraday first obtained a sample of the liquid on April 26, 1825, and communicated the result of his examination to the Royal Society on June 16, 1825; the actual discovery of benzene being made on May 18–20. He analysed his product with extraordinary skill. Using the weights then in vogue, he represented it as C_2H, *Bicarburet of Hydrogen*; to-day we write CH for C_2H. In 1833, Mitscherlich obtained Faraday's hydrocarbon from benzoic acid and changed the formula to $C_{12}H_6$, now C_6H_6. Liebig, in publishing his paper, altered Mitscherlich's *benzin* to *benzol*. The name benzene was first suggested by the French chemist Laurent. English chemists use only the name *benzene* because they have adopted the terminal *ene* as significant of hydrocarbons, assigning *ol* to alcohols; *ole* to them is meaningless. Laurent also suggested "phene."

Investigations relating to Benzene

Faraday observed that both nitric acid and chlorine acted upon benzene, but he did not separate the products. Nitrobenzene, $C_6H_5(NO^2)$, was first prepared by Mitscherlich in 1834. In 1841 this compound was reduced by Zinin and its oxygen displaced by hydrogen; he called the product *benzidam*. Fritsche, in this year, had obtained a liquid which he called *aniline*, from *anil* the Portuguese name for indigo, by distilling indigo with potash. Only in 1845 was it shown, by Hofmann, that aniline and benzidam were one and the same substance. Thus it was not until twenty years after the discovery of the hydrocarbon by Faraday that the critical point in its history was reached, when it was converted into the substance from which, about ten years later, the dyestuff was artificially made that was to be parent of thousands of dyestuffs of every possible hue.

Heterogeneous Catalysis

Stand T is devoted to the liquefaction of gases, glass and catalysis. The commencement of Faraday's interest in the subject of heterogeneous catalysis is described by him in his Experimental Researches in Electricity, Sixth Series (1833), in the following words:—"During the course of the experiments made to render the instrument (the volta-electrometer) efficient, I was occasionally surprised at observing a deficiency of the gases resulting from the decomposition of water, and at last the actual disappearance of portions which had been evolved, collected and measured." It took but a short time for Faraday to find out that it was the presence of the platinum electrodes that was responsible for the disappearance of the gas. At first he thought that the anode only was effective, and he suspected that the electrical behaviour of the plate might be responsible, but later he found that the cathodes also occasionally exhibited the property of causing the gases to combine. This indicated that the one necessary condition was cleanliness of the surface, and Faraday confirmed this view by making plates active by merely rubbing the surface with sand and stick potash and afterwards washing thoroughly. Faraday then examined a few other metals for the property of causing oxygen and hydrogen to combine catalytically, and he found that gold and palladium possessed the property, but not silver or copper. His next step was to examine the action of foreign gases on this property, and he found that small quantities of olefiant gas retard the action and larger ones stop it. With carbon monoxide a marked retardation and inhibition were noted. He distinguished clearly between irreversible poisons, such as sulphuretted and phosphoretted hydrogen, and reversible inhibitors, such as olefiant gas, carbon monoxide and ether.

Faraday pointed out clearly that the function of the catalyst was to bring about reaction in the "adsorbed phase," and if the gases could not come in contact with the metal because of the presence of an inhibitor or poison, reaction did not take place. He did not express any definite view as to the mechanism of the reaction, but he clearly did not accept the hypothesis of the presence of a film of liquid in which reaction proceeded more rapidly. He appears not to have favoured the theory of intermediate compounds in such a definite form as has been advanced by some later workers.

Electro-deposition of Metals

Electro-plating, which owes so much to the work of Michael Faraday, who first enunciated the laws of electrolysis, is dealt with on Stand U, which has been arranged by the Electroplaters' and Depositors' Technical Society. Here, too, is a special section of the British Non-Ferrous Metals Research Association, relating to the electrolytic production of metals. The engineering and many other industries have benefited enormously through the electrolytic production of metals. Electrolytically refined copper is vital to the whole electrical industry, and about 1½ million tons per annum are now produced. Again, aluminium, which has advanced in recent years more rapidly than any other metal and has attained an output of over 267,000 tons per annum, is entirely produced by electrolysis. Many other metals also are commercially produced on a large scale by electrolysis, either on account of the greater purity thus achieved or because their reduction by other methods is difficult. The growth of the electrolytic production of metals has been particularly rapid in recent years. Aluminium, zinc, cadmium, nickel, magnesium, have increased in output at a very rapid rate. Electrolytic refining has also proved its value in the recovery of precious metals.

Casks for Oils and Chemicals

J. ROBINSON AND SON, of Westgate Cooperage, Cleckheaton, are general coopers, but make a speciality of reliable casks for export trade and for oils and chemical products in particular. They were established in 1900, and in addition to the complete casks they can also supply bushes, rushes, rivets, oak shives, pegs and coopers' tools. Casks and vats are made to user's own designs, if desired.

The Production of Oil from Coal

By L. J. Rogers

The following survey of the hydrogenation problem, prepared for the Council of Scientific and Industrial Research, Australia, is of topical interest in view of the controversy already aroused in this country concerning the production of oil from coal.

THE hydrogenation of coal was first effected in 1868 by Berthelot, who obtained 60 per cent. of the original coal in liquid form by treatment with hydriodic acid under pressure at 270° C. Bergius' first experiments on the hydrogenation of organic materials and the nature and origin of coal were undertaken in 1910. By heating peat and cellulose under pressure in water, he succeeded in producing a synthetic coal, and concluded from his observation that, under suitable conditions, the chemical compounds present in coal should be capable of uniting with hydrogen to form hydrocarbons. His patents covering this process were taken out in 1913 and 1914, but the progress of experimental investigation was delayed by the war, and it was not until 1921 that his researches reached a semi-technical scale at the Mannheim Rheinau works. Of numerous other investigators who have interested themselves in the process and contributed to its development, the most prominent are Fischer, the I.G. Farbenindustrie, Waterman, Kling, Nash and Graham, Imperial Chemical Industries, and the Fuel Research Board.

Small-scale hydrogenation is carried out in the laboratory as an intermittent process in steel bombs of about two litres capacity. The semi-technical plants installed at Rheinau, East Greenwich and Billingham-on-Tees are continuous in operation, and are designed to treat about one ton of coal per day. Bergius has, in addition, a 30-ton a day plant which is used exclusively for the hydrogenation of oils and tar. A Bergius plant has also been installed at Billingham and a 100-ton plant at Duisberg. The I.G. Farbenindustrie have also developed the hydrogenation of brown coal tar on a large commercial scale, but very little practical information has been published regarding the operations of these three large-scale plants.

The Bergius Process

This process consists essentially in heating coal with hydrogen under a pressure of 200 atmospheres at a temperature between 450° and 490° C., depending on the coal used and the nature of the products desired. To facilitate continuous operation, coal is fed into the plant in the form of a paste consisting of 100 parts of coal pulverised to pass a 1–2 mm. mesh, mixed with 40 parts of topped tar or Bergin product. Although cracking and hydrogenation of the tar may proceed to a small extent, its main function is to serve merely as a vehicle for the coal. Hydrated ferric oxide—" luxmasse "—is added to the paste to the extent of 5 per cent. of the coal, primarily for the purpose of fixing the sulphur present in the coal. In this way an oil is produced partially freed from objectionable sulphur compounds, and subsequent refining treatment is reduced accordingly.

The chemical reactions upon which the process depends appear to commence with the removal of oxygen from the coal molecule, resulting in the formation of complex compounds of asphaltic nature. By interrupting the reaction at this stage, coking properties may be given to non-coking coals, a process which forms the subject of a patent issued to the Fuel Research Board. In the same way, coals which have lost their coking propensities as a result of oxidation may have these properties restored by partial hydrogenation. Continued hydrogenation gradually softens the hard asphaltic bodies originally formed. Eventually disruption of the molecule takes place, with simultaneous or subsequent hydrogenation of the resulting unsaturated compounds. In the cracking phase of the process there is a tendency for unsaturated residues to polymerise and form coke, and it is very important that conditions should be adjusted so as to enable hydrogentation to take place in preference to condensation. If the temperature of the reaction vessel is too low, no cracking will ensue, and a thick product will be obtained. If the temperature be maintained too high, cracking and polymerisation will proceed more rapidly than hydrogenation. The product will be thin and volatile, but coke will be deposited in the bomb. The time required for carrying out these reactions to completion is about two hours.

Function of the Ferric Oxide

Although the main function of the ferric oxide is to combine with the sulphur in the coal, it has been proved by various authorities that it also has a catalytic effect on the process. Its catalytic action is believed to consist in promoting cracking mainly, but it must assist in the addition of hydrogen to unsaturated compounds also. It has been found at the Fuel Research Station that the omission of luxmasse inevitably leads to coke formation when treating a very clean coal. It is very likely that the constituents of the ash itself have a pronounced catalytic effect. Of numerous other compounds whose catalytic effect has been tested, the oxides and chlorides of nickel, cobalt and zinc have been found most efficient. Catalysis accelerates the reactions and improves the yield of oils. The agents enumerated above, for instance, complete the process in two-thirds of the time required when luxmasse is used. The objections to expensive catalysts, such as these, are that they are poisoned by sulphur compounds, and cannot very well be recovered in practice.

It has been shown by Fischer and by Waterman that low-temperature coke made from brown coal can be almost completely converted into gaseous and liquid hydrocarbons under suitable conditions, but that the tar is not amenable to direct hydrogenation. Fischer concluded, in consequence, that it is chiefly the non-bituminous constituents which are hydrogenated. Other low-temperature cokes, however, do not appear to be reactive to hydrogen. His experiments indicated also that the ease with which berginisation may be effected varies with the geological age of coals, the order of activity being brown coal, long-flame bituminous, other bituminous coals, semi-bituminous and, lastly, anthracite. It is now generally accepted that the most suitable bituminous coals are those classified by Seyler as para-bituminous, and having the following characteristics: Carbon : hydrogen ratio, 14 to 16·5; carbon : oxygen ratio, 10 to 17·5; disposable hydrogen, 4·3 per cent. minimum; moisture, low. From such a coal the yields are substantially equal to those from brown coal. Nash and Graham have shown that of the microscopic constituents of bituminous coal, fusain alone cannot be hydrogenated.

At the Kaiser Wilhelm Institute a considerable amount of work has been carried out on the relative values of molecular and nascent hydrogen for the process. It has been found that sodium formate, carbon monoxide and sodium bicarbonate solution, and carbon monoxide and water, in that order of activity, are more effective than gaseous hydrogen. The use of sodium formate on a commercial scale is out of the question, on account of its prohibitive cost, but a mixture of carbon monoxide and hydrogen in the form of water gas is much cheaper to produce than hydrogen itself. Since the time of Fischer's experiments, however, the technique of the hydrogen process has improved, and it is now believed that carbon monoxide is less effective in the final cracking stage of the process than is molecular hydrogen. It is conceivable that the cheapest and most effective method of treatment may combine the use of water gas in the preliminary stages, and of gaseous hydrogen at the end of the process.

Yield of Liquid Products

The yield of products varies with the nature of the coal hydrogenated, and their quality with the operating conditions. From a suitable coal processed in such a manner as to cause neither over- nor under-cracking, a typical weight balance may be found as follows:—

Raw materials: Coal, 100; vehicle, 40; luxmasse, 5; hydrogen, 5. (Total, 150.)

First products: Crude bergin product, 128 (including vehicle and luxmasse); gas, 20; gas spirit, 2. (Total, 150.)

Crude product: Vehicle, 40 (returned to mixer); dry, ash-free liquid product, 50; water, 8; ammonia, 0·5; luxmasse and coal ash, 15; carbonaceous material, 13; loss, 1·5. (Total, 128.)

Crude spirit: 15, or 42 gal. per ton of coal.

Liquid product: Burning oil, gas oil, 15, or 37 gal. per ton. Fuel oil, 6, or 14 gal. per ton. Pitch, 14 gal. or 312 lb. per ton of coal.

Refining losses due to sulphur compounds and phenols should be low, providing that the end point of the spirit is

sufficiently low to exclude the cresols (B.P., 200° C.) and xylenols, which constitute about 5 per cent. of the oils. The value of the pitch is likely to be low on account of the ash and iron oxide from which it cannot very well be separated. The middle oils are likely to be inferior to petroleum distillates as cracking stock and Diesel fuel, for, like low-temperature tar oils, they themselves are the products of a cracking process and contain aromatic hydrocarbons. The production of ammonia liquor in a fairly concentrated form and in satisfactory quantities will be found an asset to the process.

Quantity of Hydrogen Required

In order that coking may not proceed more rapidly than hydrogenation, it has been found necessary to maintain the hydrogen content of the residual gas at not less than 65 per cent. Of the hydrogen supplied for the process no more than 5 per cent. is absorbed in the various reactions which take place. The volume of hydrogen required is, therefore, very large—approximately 35,000 c. ft. per ton of coal treated—and a cheap source of supply is very essential. Fortunately, a high degree of purity is not absolutely necessary, though desirable, and the minimum allowable content of hydrogen in the gas supplied is 85 per cent., according to Bergius. From the gaseous hydrocarbons formed in the course of the reactions, sufficient hydrogen may be prepared to meet the requirements of the process. As mentioned later, various methods have been devised by Bergius and other investigators for the recovery of hydrogen from residual and other gases. In the hydrogenation of coal, it may be found most economical to convert the residual gas into liquid hydrocarbons as far as possible, according to one of the processes discovered by Fischer, and to use the uncondensed hydrocarbons for the production of hydrogen.

The separation of the oils from the crude product is attended with some difficulty, for the solid organic and inorganic constituents are in a very fine state of division and intimately mixed with the liquor and oils present. The fact that most solvents cause an immediate separation of solid pitchy matter is another indication that the liquid product is colloidal in nature. In the process of distillation, frothing is caused by dissolved gas, and the evaporation of minute drops of water dispersed throughout the whole charge occasions bumping. For this reason pot stills can be given only very light charges, and continuous stills would probably be easily overheated. Separation by natural sedimentation takes place so slowly that the cost of settling tanks would be prohibitive. The most satisfactory method of separation yet found consists in centrifuging at a temperature of about 100° C., when 80 per cent. of the oils are recovered nearly free from solids. The water and ammonia are contained in the cake mainly, and can be recovered in the process of distilling the remaining 20 per cent. of oil. After separation of the water and solid matter, the liquid product distils without trouble.

Manufacture of the Hydrogen

The largest single item of expenditure in the working of a Bergius plant is the cost of the hydrogen used, so that a cheap supply of this gas is a matter of considerable importance. On a large scale, hydrogen may be prepared by the "steam-iron" process, from water gas by catalytic action, or by fractional liquefaction of coke-oven gas. In the "steam-iron" process, iron ore is alternately reduced with water gas to the ferrous oxide, and oxidised by means of steam to the magnetic oxide, the latter reaction producing hydrogen. About three volumes of water gas are used for each volume of hydrogen made, and the spent gas, which contains a lot of hydrogen and carbon monoxide, is used in maintaining the temperature of the plant at about 750°. In the catalytic process these two reactions take place simultaneously in the same reaction vessel. At a temperature of 500° or 600° C. the water gas equilibrium is such that a mixture of steam and carbon monoxide tends to be completely converted into hydrogen and carbon dioxide.

In the absence of a catalyst such as iron oxide, or, to a lesser degree, copper oxide, the reaction is so exceedingly slow that it may be considered not to take place at all at this temperature. The activity of the iron oxide catalyst is considerably increased by promoters whose identity is kept a very close secret by the various firms which operate this process, viz., the I.G. Farbenindustrie and Imperial Chemical Industries. The carbon dioxide formed is separated from the hydrogen by solution in water under a pressure of 25 or 50 atmospheres. Coke oven gas which contains 50 per cent. of hydrogen may be used as a source of this gas by liquefying the other constituents, chiefly methane, carbon monoxide and nitrogen. If the nitrogen content of the original gas be low, say, less than 10 per cent., a sufficiently pure hydrogen may be obtained without resorting to liquefaction.

Utilisation of Residual Gas

Since the residual gas from a Bergius plant contains about 70 per cent. of free hydrogen, and a considerable amount combined in the form of methane and higher paraffin hydrocarbons, this gas may serve as a cheap source of hydrogen for the process. These hydrocarbons may most easily be reduced to hydrogen by heat treatment in contact with various catalytic agents. Methane is the most stable of these gases, and the ultimate products of thermal decomposition of other hydrocarbons are almost invariably methane, carbon and hydrogen. The problem of utilising residual Bergius gas may then be reduced to the production of hydrogen from methane itself.

Under suitable conditions of gas velocity and temperature, and in the absence of catalytic materials, it has been shown by Fischer in the first instance that methane may be converted into higher hydrocarbons, chiefly of an aromatic nature, to the extent of about 12 or 13 per cent. The use of long heating periods at a temperature above 800° C., however, causes methane to decompose into its elements exclusively. This tendency is greatly increased by the provision of large heating surfaces, and by the presence of catalysts such as iron or nickel. Carbon black is being manufactured from waste natural gas in this manner, and one American plant is operating the process for the production of hydrogen, the temperature used being about 1,200° C. The chief objection to this process is the waste represented by the production of carbon. By mixing steam or carbon dioxide with the methane, the decomposition of carbon may be reduced and almost entirely prevented, especially when nickel is used as a catalyst. The carbon in the original gas then appears in the form of carbon monoxide mixed with the hydrogen produced. This mixture may be converted into hydrogen alone by the catalytic method, already described, of producing hydrogen from water gas.

A process of this nature has been patented by Bergius, who recommends a temperature of 1,100° C. for the preliminary reaction between steam and methane. Catalysts are not suggested for this reaction, however, though they are specified for the subsequent conversion of carbon monoxide to carbon dioxide. The I.G. Farbenindustrie has also patented a process whereby steam and hydrocarbons are passed over catalysts such as nickel, cobalt and iron, which are further activated by the addition of oxides of chromium, vanadium, potassium, magnesium and aluminium. This reaction takes place in two stages at a temperature of 300–650° C. In the first stage, the hydrocarbons are partially transformed into hydrogen and carbon dioxide. The carbon dioxide is removed by absorption in cerium oxide at 110° C., at which temperature the excess steam is not condensed. The reaction is completed in the second stage, and the carbon dioxide formed is removed as before. The B.A.S.F. has patented the use of nickel and nickel oxide as a catalyst at 800–1,000° C. Fischer and Tropsch have investigated the catalytic pyrolysis of methane in the presence of carbon dioxide instead of steam, and have found nickel and cobalt to be the most effective catalysts. The addition of aluminium oxide greatly improves the activity of these agents.

Coke Oven Gas as Starting Point

For the Bergius process, hydrogen could probably be most cheaply produced by thermal treatment of the residual gas in presence of steam. Preliminary conversion as far as possible into liquid hydrocarbons may be found advantageous. In this connection another process recently devised by Fischer may be of interest. By passing a spark discharge through coke oven gas, and subsequently hydrogenating and condensing the resulting gas with the assistance of a catalyst, about 85 grams of oil were produced from 1 cub. m. of the original gas. The electrical discharge converts some of the hydrocarbons into acetylene, which may be polymerised to form light aromatic hydrocarbons. Seventy-five per cent. of the liquid product consisted of a light spirit.

Operation of the Hydrogenation Process

In the absence of any published information on the subject, the expense of running a commercial plant can only be conjectured. Such experience of continuous operation as has been afforded by semi-technical scale plants would indicate a liability to frequent interruptions from briquetting of the coal paste in the feeding press, failure of the hydrogen compressor due to dust in the gas, mechanical troubles such as leakage from valves, gland and connections, and deposition of coke in the bombs aggravated by faults in other parts of the plant. These troubles can be minimised by careful design, by the provision of spare plant, and by close supervision by competent operators. Some degree of continuity in operation should be ensured by such precautions, but maintenance costs must always be high.

Deterioration of the plant is almost certain to be rapid. The mild steel bombs used in small continuous plants have a nominal life of only 1,000 working hours, and the makers recommend that this period of service should not be exceeded unless a core taken from the metal for inspection is found to be in a sound condition. At high pressures and temperatures hydrogen tends to attack the carbon in mild steel, weakening its structure eventually to the point of failure. In his large experimental plant, Bergius arranged that the heating gas circulating around the reaction vessel should be maintained at a pressure in excess of that inside the bomb. In this way, the reaction vessel was relieved of all bursting stress, and such leakage as did occur was into, instead of away from, the bomb. No hydrogen, therefore, came in contact with the outer containing cylinder, which was required to withstand the whole pressure exerted by the hot gas inside it. By an expensive complications of his plant, therefore, Bergius was able to prolong its useful life.

In a large plant, the handling of materials and the regulation of temperatures and pressures would be performed mechanically, so as to reduce labour costs to a minimum. The staff would then consist mainly of skilled workmen under technical supervision. The provision of automatic control equipment and the very necessary safety devices would add materially to the cost of a plant already very expensive to install. The consumption of power is high and not capable of reduction below about 400 units per ton of coal treated.

The Duisberg Plant

The capital cost of the Duisberg plant, designed to hydrogenate 30,000 tons of coal per annum, is quoted by Brownlie as £300,000. The interest and depreciation chargeable against such a plant cannot very well be less than 25 per cent., which is equivalent to £2 per ton of coal treated. Power may be estimated to cost £1 per ton of coal; labour for maintenance and operation may cost 10s., while coal and other supplies would absorb £1 per ton treated. The total expenses amount to about £4 10s. per ton. necessitating a return of £9 per ton of final products. The possibility of realising this value in free competition with petroleum products is remote, and it is not altogether certain that the duty of £3 per ton levied on oil fuels imported into Germany will be sufficient to make the process pay. It is possible, however, that the process may have been improved economically by developments which have not yet been divulged.

In the petroleum industry, a cracking unit operating at 200-250 lb. pressure and treating about 120,000 tons of charging stock per annum would cost about £50,000. The cost of a low-temperature carbonisation plant with an annual throughput of 30,000 tons is approximately £40,000. Even when due consideration is given to the extra expense of high-pressure equipment of hydrogen recovery plant, and other complications, the cost of the Bergius plant mentioned above would appear high, and capable of reduction in succeeding installations. In the absence of any information to the contrary, however, the economic position of such plants must still be considered doubtful. The commercial development of the process would appear to require simplification of the plant and its operation, or an improved yield of light spirit suitable for motor fuel.

Catalytic Hydrogenation

The only source of information relating to an important variation of the Bergius process developed by the I.G. Farbenindustrie is to be found in patent literature, and in one or two articles by Krauch, which reveal little relating to the operation of the process itself, or to its economic possibilities. The essence of the process consists in catalytic cracking and hydrogenation of tar oils, shale oil, asphaltic mineral oil residues, etc., at high pressures and temperatures for the production of light spirit suitable for motor vehicles. The patents taken out by the I.G. Farbenindustrie protect the application of various catalysts to the hydrogenation of coal and crude oils. It is claimed for combined nitrogen (ammonia or ammonium sulphide) that 80 per cent. of the raw coal is converted into liquid products containing but small quantities of phenols. Molybdenum compounds are said to be immune from poisoning, and combined sulphur (particularly in the form of metallic sulphides of the iron group) is claimed to be an effective catalyst.

Bituminous Brown Coal as Raw Material

Presumably brown coal is first hydrogenated according to Bergius's method, and the liquid product given further similar treatment. Cheap catalysts, such as the iron oxide used by Bergius himself, may be employed in this preliminary stage, but it is not likely that expensive molybdenum compounds, for instance, are mixed with the raw coal. According to Krauch, subsequent hydrogenation of the liquid product is effected industrially in the form of fine sprays conducted over the catalyst, or with the catalyst suspended in the liquid or vaporised tar. By a suitable choice of catalyst and correct adjustment of pressure and temperature, the nature of the final product can be controlled as desired. Coal may be hydrogenated in the form of a powder suspended in heavy oil, but if motor spirit is desired as the main product, it is found advisable to effect the transformation in two stages, as described, so that the unliquefied coal particles may be removed before the heavy oil is hydrogenated further.

At the Leuna works of the I.G. Farbenindustrie, bituminous brown coal is used for generating water gas according to Winkler's method, and the water gas is largely consumed in the manufacture of hydrogen for the synthesis of ammonia and the production of liquid fuels. The annual consumption of lignite, mainly for this purpose, is about 8,000,000 tons. The producer tar obtained from the water gas plants is used as raw material for hydrogenation. In 1928, the production of motor spirit from lignite was stated to be 40,000 tons, and from other raw materials 30,000 tons. The expected production during the year 1929 was estimated at 250,000 tons, but it is not known whether this hope was realised. This amount, however, represents practically the whole of Germany's requirements of motor fuels.

An Improved Vacuum Recorder

Barometric Pressure and Temperature Corrections

In the measurement of vacuum on impregnating tanks, evaporators, distilling plant, vacuum systems, etc., there is need of a gauge which records on a chart the vacuum in terms of absolute measurement, automatically corrected for barometric pressure and temperature. The type of recording vacuum gauge commonly used gives a record of pressure below atmospheric pressure, but as the atmospheric pressure varies from time to time, it is obvious this record bears no relation to the true pressure above absolute zero unless corrections are made for barometric pressure. These corrections may be approximately 10 per cent. To meet this demand Negretti and Zambra have, therefore, introduced an absolute vacuum or pressure recorder which requires no correction for barometric pressure or temperature. This instrument is mounted in a cast iron fume-tight case. The chart is of the disc type 10 inches diameter, rotated by clockwork once per day or other required speed, and the absolute pressure is recorded on the chart by an ink pen. The instrument is also provided with one connection for coupling to the vacuum pipe through any filters or separators that may be necessary. The mechanism is fully compensated for temperature change over a range of normal air temperature variation. This is effected by suitably proportioning the volume of the space inside the diaphragms when closed to that when open, and leaving a definite amount of dry air inside. This vacuum recorder is not suitable for measuring the last degree of high vacuum such as fractions of a millimetre of mercury. The minimum range is 0 to 4 inches mercury (0 to 100 m/m.) where 0 = " absolute " vacuum.

Some Considerations of the Zinc Oxide Trade

By O. W. Roskill

This article reviews the relative merits of zinc oxide produced by direct and indirect processes, and also points out the possibilities of the Coley process for the reduction of zinc ores, as ultimately applied to the manufacture of zinc oxide.

THE manufacture of zinc oxide has hitherto been carried on by two processes. In the direct or American process, the zinc ore is reduced by anthracite and the zinc vapour evolved is oxidised by air in a continuous operation. In the indirect, or French process, spelter is used as the source of zinc. The direct process, which is sometimes known as the Wetherill process, was originally developed by the New Jersey Zinc Co., and resulted from their inability to produce spelter successfully from the complex New Jersey zinc ores. The indirect, which is older, resulted from attempts in the eighteenth century to combat the prevalence of lead poisoning among painters.

The Direct Process

In the direct process, brickwork kilns with arched roofs are used, and the grate is composed of flat, cast-iron bars perforated by tapering holes, narrow on the upper and wider on the lower side of the bars. A layer of finely crushed anthracite is spread on the grate, and a mixture of ore and coal placed above it. The air blast enters through a flue into the ash pit below the grate, and zinc vapours are evolved from the ore through reduction by the carbon monoxide formed. Re-oxidation takes place in the furnace chambers in the presence of carbon dioxide, and the oxide fume is carried by the gas stream through an outlet in the roof of the kiln into a main, from which it passes to brick settling towers. There are usually two towers for effecting the deposition of ash before the fume is driven by fans into the actual cooling and settling rooms. A certain amount of oxide is deposited in the latter, and the remainder passes to the bag-house, which consists of parallel iron pipes arranged horizontally and having a series of outlets from which muslin or calico bags are suspended. The latter are set in barrels and can be opened to allow the removal of the oxide, which is then dried and sieved ready for packing.

The Indirect Process

In the indirect process there are two types of furnace employed—the retort and the crucible type. The retorts are usually made of clay and the arrangement resembles that in an ordinary zinc distillation furnace. The vapours pass to a combustion chamber, into which a regulated supply of air is drawn by fan suction. The oxide formed is conveyed by a main to the bag-house, which is very similar to the one used in the direct process. In some plants carbon monoxide and dioxide from a coke producer are passed over the surface of the zinc, in order to avoid oxidation taking place in the retort, and partly, to convert any lead present into the carbonate. Crucible furnaces usually consist of a battery of eight graphite crucibles each with a capacity of about half a ton of zinc. These crucibles are provided with lids in which there is a central hole from which the zinc vapour issues. Oxidation takes place immediately above the crucible, and the fume is drawn by a fan into a hood suspended a few inches above the lid.

Variations and improvements on the above basic methods have been described from time to time. Rotary furnaces have been tried, both for the direct and indirect processes, for instance; in the former case by the Kirk-Simon Smelting Co. of the United States, and in the latter case under the Cornillet process, which uses an oil-fired rotary furnace and claims to avoid the formation of dross and to give a product of high degree of fineness. Patents have also been taken out in the United States for the addition of the spelter to a slag which is claimed to retain the impurities, the mixture being heated electrically.

Merits of Direct and Indirect Oxides

A matter of primary importance, and one which has always given a great deal of trouble, is to obtain the oxide undiscoloured by impurities. Cadmium, which is often present in zinc ores, is more volatile than zinc, boiling at 778° C., as against 930° C. in the case of zinc, and owing to the pronounced tinctorial powers of cadmium oxide, as little as 0·1 per cent. will definitely discolour zinc oxide. The hard spelter generally used in the indirect process averages 93 to 94 per cent. zinc, the remainder being lead, cadmium and iron. The iron remains behind in the retort and is not a source of trouble, but some of the lead may be carried over and will impart a pinkish tinge to the product unless present as the sulphate, when it produces a slight darkening. The use of carbon dioxide to convert the lead into carbonate has already been mentioned, and as lead carbonate is much heavier than zinc oxide, it tends to settle in the first condensing chamber, and thus provides a fairly effective means of separating most of the lead, which is present in the original spelter.

The relative merits of direct and indirect zinc oxide has been a subject of controversy. The average indirect zinc oxide, though it is more expensive to produce, is of a higher degree of purity, and is, therefore, more suited to the demands of high-grade paint and enamel manufacturers. Direct zinc oxide, on the other hand, though usually of lower purity, is often in a finer state of division, which is of importance in the manufacture of rubber goods; when used as a paint it is sometimes stated to be more durable than the indirect oxide. Zinc recovery effected by the direct process is somewhat low, and according to patents held by the New Jersey Zinc Co., the rate of cooling of the oxide after its formation has a marked effect on the particle size, rapid cooling producing the finer division. If the zinc vapour is electrically preheated, however, the zinc oxide is probably formed in the gaseous phase, and by introducing a current of relatively cold air, and at the same time rapidly removing the fume by means of fan suction, condensation of the oxide in a very fine state of division is effected, as there is not time for agglomeration to take place.

Commercial Grades Available

Three main grades of zinc oxide are usually marketed—White Seal, the finest, is used chiefly in enamel manufacture; Red Seal is the second grade, also suitable for the paint industry; Yellow Seal is employed chiefly in the rubber industry. A certain amount of leaded zinc oxide is also sold; this contains from 5 to 35 per cent. of basic lead sulphate, and although it has fair hiding power, it is not so white as zinc oxide.

The rapid development of the rubber industry since the war has created an increasing demand for zinc oxide which functions as a reinforcing agent, increasing the tensile strength of the rubber and the resistance to abrasion and tear. It also acts as an activator for organic accelerators. It improves the ageing qualities of the rubber by counteracting the tendency to deterioration under the action of light and heat. As a paint zinc oxide is being used increasingly in admixture with other substances, such as white lead and barium sulphate. It is particularly valuable owing to its freedom from discolouration by gases and its power of withstanding atmospheric conditions. The oil absorption is 12 to 15 per cent., being lower for direct than indirect oxide.

Production Costs and Market Prices

Pure zinc oxide contains 80 per cent. of zinc, and the theoretical yield from pure zinc by the indirect process should therefore be 125 lb. of oxide for each 100 lb. of zinc used.

In practice, however, using hard spelter, the yield of oxide rarely exceeds 100-105 lb. for each 100 lb. of spelter; skimmings and ash constitute about 10 per cent. and tops 3-4 per cent. On a crucible plant of 50 tons per week capacity, labour costs amount to 10-15 per cent. of the total cost of production. The coal consumption amounts to about 13 cwts. of slack coal per ton of spelter, and the cost of crucibles is approximately the same percentage of the total as that of coal. The spelter used constitutes about 70 per cent. of the total cost of production and in view of the enormous fall in the price of the latter, it is somewhat significant that zinc oxide prices have not shown more than a 16 per cent. drop from the 1928-29 level.

Average Price of White Seal Zinc Oxide (London) :—

1926	£44	9s. per ton
1927	£42	19s. ,,
1928	£42	0s. ,,
1929	£42	0s. ,,
1930	£39	3s. ,,
1931 (Jan.-June)	£36	13s. ,,

The American quotations have been entirely stabilised since the end of 1926 up to the present time. White Seal zinc oxide (French process) has remained at 11⅝ cents per lb. (barrels, car lots), corresponding to £53 10s. per ton. Green Seal grade (French process) has remained at 10⅜ cents per lb. (bags, car lots), equal to £47 15s. per ton; and Red Seal (French process) at 9⅜ cents per lb., equal to £43 5s. per ton. Lead-free American process oxide has remained at 6½ cents per lb. (bags, car lots), equal to £30 per ton; and leaded zinc oxide (10-25 per cent.) at 6⅞ cents per lb., or £31 15s. per ton.

Possibilities of the Coley Process

Because of the favourable position of the industry as regards the relation between the raw material costs and the selling price of the product, the efficiency attained is usually not of a very high order, and there appears to be ample scope for lowering the costs of production. The possibilities of the Coley process are of considerable interest in this connection. This process effects the reduction of zinc ores by means of highly active carbon produced by cracking heavy hydrocarbon oils in an internally-heated rotary kiln. A controlled amount of air for the purpose of maintaining the reduction temperature is admitted through rows of ports arranged longitudinally along the outside of the kiln and fitted with counterweighted flaps which open and close as the tube rotates, and so ensure that the air comes into contact only with the gases above the charge, and not with the charge itself.

The product, which is carried away with the gases produced by the reaction, passes to a water-jacketed cooling tower, in which the ore dust is deposited, then to cyclones which separate about half of the total product, and finally to the bag house where the remainder is collected. It consists of zinc oxide and fine carbon soot in the proportion of, say, 74 per cent. of oxide to 16 per cent. carbon, together with a certain amount of impurity consisting chiefly of ore dust, lead oxide and some free metallic zinc. This product is intended for distillation to spelter, for which purpose it is first briquetted. The process is, however, equally applicable to the manufacture of oxide, in which case the free carbon content is kept as low as possible, for by burning out the residual carbon and subsequent treatment various grades of oxide can be made. A high-grade oxide suitable for the paint industry has been prepared, but there is also a considerable market for "off-colour" oxide (which can be cheaply made in this way) in the rubber industry.

Quality Requirements in Industry

The requirements of different rubber manufacturers vary somewhat, as also do the prices, but a lead content below 0·4 per cent. is usually accepted as satisfactory. The lead content of oxide made by the Coley process can be reduced to 0·13 per cent., when necessary. A very large part of the consumption of zinc oxide in the paint industry also goes into uses which do not require the highest grades, i.e., for greys and neutral colours, for mixing with other paints, and for purposes where covering power combined with resistance to sulphurous gases is a primary consideration. With little or no treatment, oxide from the Coley process is able to meet these demands at a cost which cannot be reached by the indirect process even at the present price of spelter. A further important use for low grade or refuse oxide is in lithopone manufacture. Refuse oxide from ordinary oxide plants is suitable for very little else and consequently sells at a low price for this purpose, but there is no reason why oxide made by the Coley process should not enter into this field.

In the United States the Zinc Manufacturing Co. operates a plant at Dartford, consisting of six units, and has recently completed a second plant at Tunis, consisting of 12 units, the total capacity (on a 50 per cent. ore basis) being 50,000 tons of zinc per year. This company is now concentrating on the production of oxide which offers a more satisfactory profit than spelter at the present time. The Dartford plant is not working to capacity, but since the imports of oxide averages 12,000 tons per year, the existing domestic output is not likely to be seriously disturbed when it is seen that, as the price of spelter improves and the new distillation process at present under trial there is perfected, increasing quantities of the oxide-carbon product will be utilised in the production of spelter.

World Production Statistics

Zinc oxide statistics are very limited. The United States is by far the largest producer, but in 1930 ranked below Germany and Belgium in volume of exports. The following table shows the estimated production of zinc oxide in the more important countries during 1929 :—

	Tons.
United States	143,200
Germany	30,000
Belgium	28,000
France	25,000
United Kingdom	23,000
Poland	9,000
Russia	7,500
Italy	6,000
Holland	4,000
Sweden	3,600
Other countries	15,000
Total	294,300

On the whole, the situation is one of fair stability, although Poland, for instance, is making strenuous efforts to increase her output and exports, which were formerly considerably above the present level. Here the Polskie Zaklady Przemysly Cynkowego Sp. Akc. has recently completed a new factory at Bendzin, with a capacity of 3,000 tons per year, which will later be increased to 5,000 tons. In Germany, a new plant, which is outside the German Zinc Oxide cartel, has recently been erected at Oker (Harz). The United States exports chiefly to Canada and the United Kingdom; Germany to Sweden, Holland, Denmark, Switzerland and the United Kingdom; Belgium to Brazil, the United Kingdom and Holland; France to Algiers; and the United Kingdom to France and Syria. A summary of exports and imports during 1930 is set out below :—

	Imports.	Exports.
United States	—	10,753 short tons
Germany	1,673	12,685 metric tons
Belgium	2,387	11,338 ,,
France	1,563	3,239 ,,
United Kingdom	10,775	2,797 tons

The Institute of Metals

Busy Winter Session in Prospect

THE Institute of Metals has just issued its full programme of meetings for the winter session both of the parent Institute and of its six local sections. The latter are seen to be centred in Birmingham, Glasgow, London, Newcastle-on-Tyne, Sheffield and Swansea. In each of these industrial centres there will be given from October to March a series of lectures dealing particularly with local metallurgical and engineering problems. In all, over forty meetings have been arranged.

Among the subjects to be dealt with are mechanical testing of metals; the casting of "tough-pitch" copper; electric welding of non-ferrous alloys; the extrusion of metals; recent advances in rolling plant; X-ray examination of alloys; protective coatings on metals; die-casting; defects in non-ferrous castings; refining of copper, new alloys and brass foundry; notes on condenser tubes and their packing; aluminium-silicon alloys, gases in metals; engineering silver solders; stresses in metals; the technique of enamelling; the use of cast iron in the non-ferrous industry, and some causes of unsoundness in non-ferrous alloys.

Next year's autumn meeting, it is announced, will take place during a visit to the United States and Canada, September 3 to October 8. Copies of the programme can be obtained on application to the Secretary, Mr. G. Shaw Scott, 36, Victoria Street, Westminster, S.W.1.

Japanese Market for Tanning Materials

THERE is a growing market in Japan for tanning materials. Imports through the ports of Kobe and Osaka, which handle a large percentage of the tanning materials, increased in 1930 to 16,473,000 lb. valued at £134,000 compared to 1929 imports of 15,975,000 lb., worth £106,000. Wattle bark forms the major portion of the materials imported, followed by quebracho extract, wattle bark extract, and oak bark.

Industry and the Trade Balance

Views of the Federation of British Industries

THE Federation of British Industries, according to a statement which has been issued by its president, Sir James Lithgow, Bt., considers that a tariff policy should now be adopted in this country, with the object of correcting the balance of trade by the limitation of imports; and stimulating British industry by adequate protection in the home market, thus giving industry the opportunity, by this assurance of increased production, of being able to reduce costs and thus expand exports from this country.

In view of the pressing need for immediate action, it is suggested that a temporary tariff of a simple character should immediately be put into force. This tariff should be on an "ad valorem" basis, graded into classes, the rates ranging from free entry for goods in the first class by graded steps up to a maximum for goods placed in the last or highest class. In determining the commodities to be assigned to each class, the guiding principle should be generally that the nearer a commodity is to a completely finished article the higher the rate of duty which it should bear when imported from a foreign country. It would also be necessary to include power to take such action as may be necessary to limit imports or prevent dumping, with suitable powers of dispensing, licensing and revising, in order to meet cases of temporary, but serious, dislocation or inconvenience. This temporary tariff should be followed as speedily as possible by a more permanent tariff calculated to meet more exactly the requirements of the industrial situation.

In bringing about this change in the fiscal system (the statement continues), it must be borne in mind that (1) the object of the tariff is to provide the greatest possible amount of employment and by increased production to cheapen prices and thus not only benefit the home consumer, but assist in the expansion of the export trade; (2) the necessity of considering the interests of industries which rely upon imported raw materials, or whose raw materials are themselves the finished products of other industries; (3) the importance of reciprocal agreements for preferential treatment with the Dominions; (4) the need for elasticity in the tariff from the point of view of treaty negotiations with foreign countries; and (5) the stimulation of agriculture in Great Britain. The temporary tariff should thus afford an effective measure of protection to home industries, prevent dumping, and make provision for a wide extension of preferential trade within the Empire.

The Federation is apparently convinced that no other method of restricting imports can meet the essential requirements of the situation. A flat rate tariff on all commodities, if at a sufficiently high rate to restrict imports to the required extent, would be a serious handicap to the export trade of all industries and particularly to those industries which rely upon imported raw material. Classification is also essential if harm is not to be done to many industries.

Spiral Gilled Tubes for Heating and Cooling Plant

ROBERT JENKINS AND CO., LTD., of Ivanhoe Works, Rotherham, are makers of spiral gilled steel tubes which are now available in tube diameters from 1 to 4 inches and in any convenient lengths up to 20 feet. These gilled tubes are very effective for cooling or heating plant, as they are light, unbreakable, and take up very little space per sq. ft. of heating surface. Among their other productions are calorifiers with a capacity of 250,000 B.Th.U., or 200 gallons per hour, using steam at 25 lb. gauge pressure; containers in Firth's Staybrite steel; and mild steel tanks.

New Iodine Factory in Norway

A NEW Norwegian company intending to manufacture iodine from kelp ash has recently been organised. This enterprise is said to be sponsored by an Oslo paint firm. The factory, which will require about 500 metric tons of kelp ash annually, is now being constructed near Kopervik. There are at present two other iodine producing concerns in Norway, the Skaalevik Kemiske Fabrikker A/S, at Bergen, and Lofotens Kemiske Fabrikker, at Stamsund. Most of the kelp ash produced is ordinarily purchased by the Iodine Trust.

A Bookman's Column

THE appearance of Volume III of the *Dizionariod i Merceologia e di Chimica Applicata* (Ulrico Hoepli, Milan, pp. 1043, 60 lira), is a reminder of the steady progress that is being made with this important and learned work under the direction of Professor Vittorio Villavecchia and his associates. The present volume covers the interval Naftalina to Sena, so that the work is now well on the way to completion. The treatment of the different subjects continues to be very complete and thorough, and an effort has clearly been made to bring the matter as nearly up to date as possible.

* * *

DEVELOPMENTS in the artificial silk industry during the past two and a half years have fully justified the publication of a second edition of *The Manufacture of Artificial Silk*, by E. Wheeler (Chapman and Hall, Ltd., pp. 177, 12s. 6d. net). This volume is one of a series of monographs on applied chemistry published under the editorship of Dr. E. Howard Tripp, and has a foreword by Sir William J. Pope, who states that "improvements in the manufacture and application of artificial fibres, which are certain to be made with ever increasing rapidity, will ultimately raise the artificial fibre from the rank of an auxiliary to the natural fibres to that of a powerful competitor with them." The development of this comparatively new industry has undoubtedly been retarded by the meagre scope of our chemical knowledge of the various forms of cellulose which constitute the raw material of the artificial fibre, and as a field of investigation this matter is attracting the attention of many chemists and engineers. It is for this reason that the second edition of this book will find a cordial welcome in showing what has been already achieved.

* * *

IT was an important service for scholarship and for chemical science to bring together in one compact volume the papers of Carl Wilhelm Scheele, with appendix and index, and many will be grateful that this has been so well done. *The Collected Papers of Carl Wilhelm Scheele*, translated from the Swedish and German originals by Leonard Dobbin, Ph.D., lately Reader in Chemistry in the University of Edinburgh, is an attractive volume of 367 pages (G. Bell and Sons, 10s.). Its publication, as the editor and translator explains, marks the fulfilment of a long-cherished desire, inspired by an intense admiration for the chemical genius of Scheele, to present in a single volume and to place within the reach of students of chemistry and its history, as well as of other interested readers, translations of all Scheele's papers as they appeared in various scientific journals and also of his famous *Treatise on Air and Fire*. The work of translation was begun many years ago and the comparative leisure of retirement has at last made its completion possible. Mr. Dobbin may be congratulated on the finish of a fine piece of work.

* * *

PROFESSOR J. R. Partington's original *Text Book of Inorganic Chemistry for University Students*, first published in 1921, continues so steadily in demand that the third edition has now appeared (Macmillan and Co., pp. 1083, 15s.). The book is already so well recognised as a standard work in this field that little requires to be said beyond pointing out the thorough revision that it has undergone. The reception given to previous editions encouraged Professor Partington to a further attempt, by a close revision of the whole text and by the addition of new sections and the simplification of some of the old, to make the book more acceptable and useful. In this revision the type has been re-set, although as little disturbance of the arrangement as possible has been made, a feature that teachers will appreciate. The result is a first class reference book at a distinctly moderate price.

Dimethyl Sulphate

A REPRESENTATION has been made to the Board of Trade under Section 10 (5) of the Finance Act, 1926, regarding the exemption of dimethyl sulphate from Safeguarding Duty. Any communication should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, S.W.1, within one month from the date of this issue.

Chemical News from South Africa

[From a Correspondent.]

Towards the end of August the last of the road tests on power alcohol made from Rhodesian maize was carried out. The Government was so struck with the result that it has decided to protect the manufacture of power alcohol from Rhodesian vegetable products by allowing a rebate in the duty on petrol granted to purchasers of alcohol. A mixture of 20 per cent. of alcohol with petrol seems to be the most suitable. In the tests some of the cars reported diminished power, but many noted an increase of power. When the general average was taken, the results from the mixture were found to be slightly better than from undiluted petrol.

Bleaching Process for Peanuts

It is claimed that a Johannesburg inventor has discovered a new chemical process that could be used excellently for bleaching Valencia, Nigerian and Chinese peanuts, as well as for the South Africa product. It is believed that the representatives of a leading British firm are trying to acquire the rights to the process, but South African growers are eager for the Department of Agriculture to purchase and to keep the process in South Africa. If this is done and all the virtues claimed for the process are realised, it will give South African growers an overwhelming advantage over growers in other countries. The process is rapid and inexpensive. It is said to clean and bleach unshelled South African peanuts so effectively that their appearance will be superior to that of Valencia peanuts, which fetch at least 18s. per cwt. more on the London market than the South African nuts. A few small parcels of Transvaal nuts cleaned by this process have been landed in Liverpool, and the report so far has been very favourable. As a fair quantity of the South African peanut crop is raised in red soils, which produces nuts only suitable for the local market, this process is important in that such nuts can be cleaned to the same degree as nuts raised in ash turf soils. As immature nuts are automatically removed by the process, the samples produced are of the best quality. South African growers are so deeply interested in the process that they fear that if it is allowed to go overseas, they will suffer serious loss of trade.

New Perfumery Products

There will be a new development in the South African perfumery trade when the Paarl Co-operative Wine Growers' Association enter this market within a week or two. As a means of using up the large quantities of surplus spirits stored in its cellars, it has begun the manufacture of two perfumes, the better of which is to be known as "Eau de Cologne." The other will be named "Eau de l'Afrique." Both are to bear the labels of the association, so that there will be no attempt to sell these products as overseas manufactures. Only about ten per cent. of the ingredients are to be imported. Large use will be made of orange distillate from South African orchards. The Eau de Cologne is to be colourless, but the other product will readily be recognised by its pale lemon hue. As these products are to be in every respect equal to the imported, a large sale in South Africa is anticipated, and it is also expected that as the industry develops a determined attack will be made on overseas markets.

South African Salt

South Africa has long been almost self-supporting as regards salt, but recent advances in agriculture and industry have led to a careful investigation of grading and production of this valuable commodity. The annual production is about 92,000 tons, valued at £124,000. South African salt has been used for curing hides and skins, and the poor results that have sometimes followed is undoubtedly due to the presence of calcium and magnesium in too large a quantity. Some samples of salt have had more than four per cent. of anhydrous sodium carbonate. More attention to this and other factors must result in the production of better grades of salt, especially if the most modern processes are introduced in factories.

Maize Products

South African maize has of late been attracting wide attention among manufacturers who still anticipate the development of a large by-products industry. Maize corn represents a large part of the South African export trade, and as this grain is of good quality it is frequently pointed out that much greater gains would be made if this was converted into various important products and then exported. It is suggested that starch could be made in fair quantities for local use, and that in addition gluten and steepwater could be produced at the same time. Although a considerable amount of discussion has taken place and there have been rumours of flotations, no companies have yet been registered. However, if the energetic promoters now striving to interest capitalists in their schemes succeed, it may not be long before much of the starch used in the South African textile industry, by bakers and confectioners and others, will be made in the country from maize.

Chemical Matters in Parliament

Dead Sea Salts Concession

In the House of Commons on Monday, September 21, Colonel Howard-Bury asked the Under-Secretary of State for Foreign Affairs whether he has had further communications with the French Government regarding the Dead Sea concessions granted to Mr. Moses Novamesky; and whether the case is being brought before the Hague Tribunal?

Captain Eden: A note was addressed to the French Ambassador on July 10 to the effect that, as the French Government had not accepted the offer of arbitration which His Majesty's Government in the United Kingdom had made to them in July, 1930, that offer must be regarded as having lapsed. The answer to the second part of the question is, therefore, in the negative.

Colonel Howard-Bury: Does my hon. and gallant Friend mean that the French are not going to appeal at all to the Hague Tribunal?

Captain Eden: The British Government made an offer to the French Government to go to arbitration, if the French Government would also arbitrate on certain other matters—claims which we had against them. They have not acceded to our offer and therefore the offer has been withdrawn.

Scientific and Industrial Research

On Tuesday, September 22, Mr. Scott asked the Lord President of the Council (Mr. Stanley Baldwin) whether the Industrial Research Department carries out investigations on behalf of private firms or companies; if so, under what authoritity it does so; how many such investigations have been made during recent years; and whether fees are charged?

Mr. Baldwin: The Department of Scientific and Industrial Research carries out special investigations for private firms and companies on repayment, under conditions which have been approved from time to time by my predecessors and by His Majesty's Treasury, and in accordance with provision made annually in the estimates of the Department. Particulars of the numbers of such investigations undertaken in recent years are not available, but the estimated receipts of the Department during the current financial year on this account amount to £22,500 approximately. This sum does not include test fees or contributions made by private firms, companies and individuals towards the cost of investigations included in the normal programme of the Department. Receipts from these sources are estimated at £53,500 in the current financial year.

Sale of Japanese Dyes to Soviet Russia

The Soviet Trade Representation, according to the *Yakugyo Shuho*, of Tokyo, have approached the Mitsui, the Nissen, and Teisen, which are the three major manufacturers of dyes in Japan for the purchase of their products amounting, it is said, to some two million yen. This purchase is said to be necessary for an expansion in the Soviet dye factories as part of the five-year plan. It is understood that the prices of Japanese dyes are cheaper than German products by 30 per cent.

Recent Trade Publications

Pressure Gauges and pressure gauge connections is the subject of a well-illustrated booklet just issued by the Bordenberg Gauge Co., Ltd., of Broadheath, near Manchester.

The Blancometer, an instrument for the accurate specification of nearly-white colours, in paper, fabrics, paint, powder and all raw materials and products, is described in a leaflet issued by Adam Hilger, Ltd., of 24, Rochester Place, Camden Road, London, N.W.1.

The Reorganisation of Science

[To the Editor of the Chemical Age.]

Sir,—The interest taken in the meeting of the British Association, and the ever-increasing demand that science must associate itself more closely with every-day life makes it necessary that some steps be taken to consolidate the scientific position and strengthen it before such developments can be brought about within a reasonable time.

In this direction I have previously suggested that the Royal Society should double its membership, which is still something of the order of this in its early days, when science was in a rudimentary stage of development.

Another important step would be the amalgamation of the British Association, the Society of Arts, and the British Science Guild into one organisation. On the political side the newly-formed League of Science is already busily engaged in influencing the main political parties to increase the number of parliamentary candidates who possess scientific qualifications and in other directions. The present position of our scientific societies is incomplete, and almost out-of-date when one remembers the extraordinary developments in industrial science and inventions, and the dislocating and in some cases almost disintegrating effect of their influence on many branches of industry.—Yours, etc.,

W. P. Dreaper, F.I.C.

Hampstead Heath, London, N.W.3.
September 19, 1931.

Huddersfield Technical College

Courses in Textile Chemistry and Dyestuffs

Courses at the Huddersfield Technical College have been devised to provide adequately for those who intend to become chemists or for those who desire to include general chemistry in their studies for other careers. The complete day course, extending over four years, is recognised by the Institute of Chemistry as a preparation for admission to the examination for the Associateship of the Institute (A.I.C.), and courses are also arranged to assist those preparing for the examinations of the Institute in special branches.

The work of the chemistry department is co-ordinated with that of the independent department of dyeing, which itself is housed in commodious quarters, possesses a fine collection of dyewares, and is well equipped with scientific instruments for the study and technical analysis of dyestuffs, chemicals and textile materials. By the generosity of the late Mr. Samuel Firth, a special laboratory was furnished and equipped for the study of the physical and optical aspects of dyeing problems. The dyehouse is provided with model machines for dyeing loose fibre, yarns or pieces on a large scale, and the material handled is required for, or produced by, the textile department of the College. A steady output of research work on dyeing problems has been maintained for several years, and a valuable Research Scholarship given by the Worshipful Company of Drapers is tenable in the Department. In 1916, a special department of colour chemistry was founded to give advanced teaching in the chemistry of the synthetic colouring matters.

The research phase has undergone progressive development since its foundation in 1916, and no fewer than 100 original papers and memoirs have been published in scientific journals of repute. Moreover, students have recently obtained the Doctor of Philosophy (Ph.D.) Degree of the University of London and others are well advanced with their theses for the doctorate. In addition, several patents have been taken out in connection with researches which appear to be of use to industry. The head of the Department of Chemistry and Colour Chemistry (Dr. H. H. Hodgson) was awarded the Dyers' Gold Medal for Research in 1927 and again in 1930.

The research laboratories of the department are open to graduates (chemistry as principal subject) of any recognised university, to those who have passed an examination of equivalent standard, and to such other students as are able to satisfy the head of the department of their ability to conduct research. Valuable research studentships have been founded to enable students to continue their studies after graduation.

Vats for Chemical and Dye Works

Vat making is a section of the cooperage industry which calls for special treatment, and in this respect Robert Airey and Son, of "Kuvo" Works, Kingsbridge Road, Huddersfield, are exceptionally well equipped. Mr. Robert Airey, after being in the cooperage business in Brighouse for 20 years, established the above firm at East Parade, Huddersfield, in 1905, and in 1920 new works were built at Kingsbridge Road, where a full plant of special vat machinery is installed. The firm now specialise in all types of vats, becks and cisterns for the chemical, dye and allied trades.

Huddersfield Technical College: Part of the Chemical Laboratory.

From Week to Week

PROFESSOR J. C. MCLENNAN, who was scientific adviser to the British Admiralty during the war, is retiring from his position as professor of physics at the University of Toronto, and will come to England and live in Surrey.

DR. C. R. AUSTIN will attend the Third International Conference on Bituminous Coal, to be held at the Carnegie Institute of Technology, Pittsburg, Pennsylvania, November 16–21, as representative of the Institute of Chemistry.

RECENT WILLS include :—William Allan Wharram, of Rossington Bridge, near Doncaster, founder and managing director of W. A. Wharram, Ltd., wholesale and manufacturing chemists, Leeds, £35,588, net personalty £24,929.

THE SPALDING BEET SUGAR FACTORY is to open early in October, but a definite date has not yet been fixed. The acreage this year in South Lincolnshire is reported to be about the same as last season. The capacity of this factory is now double what it was when first opened.

AS A RESULT OF HIS APPOINTMENT as President of the Board of Trade, Sir Philip Cunliffe-Lister has resigned the chairmanship of the Tin Producers' Association and of the Council. Sir George Maxwell has been unanimously appointed chairman until the next ordinary general meeting of members.

THE divisible estate in Jersey of the late Lord Trent of Nottingham (formerly Sir Jesse Boot) has been valued at £120,000. This is exclusive of several properties in the island bequeathed to the widow under the realty will, and represents the actual value of Jersey property divisible among the heirs. Lord Trent's English estate was sworn at £222,317 gross and £194,755 net personalty.

ANY HOPES THAT dyeworkers in the Yeadon district may have had of the re opening of the Kirk Lane Dyeworks, Yeadon—which closed down 16 months ago, throwing 300 people out of employment—have been shattered by the announcement that the premises have been purchased by the Yeadon Waterworks Co. The water company's chief object is to secure the dyework's private water rights. The works have a borehole capable of yielding 15,000 gall. per hour.

NOTICE IS GIVEN BY THE LIQUIDATOR of the Alianza Co., Ltd., the Lagunas Nitrate Co., Ltd., the Liverpool Nitrate Co., Ltd., and the Pan de Azucar Nitrate Co., Ltd., that he cannot apply to Cosach for new shares until he receives the old certificates of the various companies from the holders. There are still a number of shares outstanding, and he requests those who have not yet done so to forward their holdings, both Registered and Bearer, to be exchanged for shares of Cosach. The liquidator's address is Friar's House, New Broad Street, E.C.2.

LEADING REPRESENTATIVES of the various technical and scientific branches of the mining industry were present when the Lancashire and Cheshire Coal Research Association's new research laboratory at Cheetham, Manchester, was opened on Thursday last, September 22, by Mr. Robert A. Burrows, a vice-chairman of Manchester Collieries, Ltd., and a pioneer of coalfield research. In the new laboratory are offices to house the two mining investigators who are working under the Safety in Mines Research Board scheme. The equipment includes machinery for screening tests in connection with the grading of coal, and apparatus for grinding and sampling.

THE UNITED STATES DEPARTMENT OF AGRICULTURE, in co-operation with Iowa State College and the University of Illinois, is inaugurating factory-scale experiments in the utilisation of farm by-products. It is intended to make a comprehensive study of farm wastes and by-products utilisation with a view to finding a more profitable outlet for surplus cornstalks, straw, oat hulls, cotton seed hulls, and other similar materials. One of the first activities in connection with this work will be the development and perfection of a process whereby packing-house, cannery, and creamery wastes which now present a serious problem of sewage disposal, are combined with farm wastes, such as cornstalks and oat hulls, in such a way that the soluble portion is fermented out by anaerobic organisms that produce inflammable methane gas having the valuable properties of ordinary illuminating and fuel gas.

MR. C. G. LYONS, of Cambridge, has been appointed lecturer in chemistry at the Bradford Technical College.

WORKMEN engaged in the steel melting shop of Steel, Peach, and Tozer, Ltd., of Templeborough, Sheffield, were injured on Saturday last, September 19, when a ten-ton slag heap exploded, due to over-rapid cooling.

GERMANY'S RAW STEEL OUTPUT shows a further decline for August, the total being 688,972 metric tons, against 803,261 metric tons in the previous month. The corresponding figures for August, 1930, were 896,339 metric tons.

THE services of an experienced technical commercial engineer with connection in the chemical trade are required by a large engineering firm. Further particulars will be found in the small advertisement section of this issue of THE CHEMICAL AGE.

THE MEMORY OF ALEXANDER SCOTT COUPER, the distinguished chemist, is to be preserved by the erection of a memorial plaque on the wall of the house in which he was born at Kirkintilloch. The opening ceremony will take place on October 9.

A MERGER has been formed between the two biggest German cement manufacturing concerns, the Dyckerhoff and Wicking companies. The merger company will be called the Portland Cement Works Dyckerhoff-Wicking A.G. It will have a capital of Rm. 27,000,000, and will cover almost one-third of the total domestic sales of cement.

THE MANUFACTURE OF ZINC OXIDE which was carried on for a number of years at Callington, East Cornwall, until lack of materials during the war led to its discontinuance has now been revived. The prospects of the re-established industry are said to be excellent, the whole of the estimated output for the coming twelve months having been disposed of. The owners, the Callington Oxide Co., have acquired the old-established Western Pigment Co., Ltd., which has a complete paint factory at Cattedown, Plymouth, and the merged concern (the head office of which will be at Callington) is to be known as the Western Oxide and Paint Co.

ACCORDING to the *Irish Trade Journal*, published by the Department of Industry and Commerce of the Irish Free State, the following firms were successful in obtaining contracts for the supply of chemicals to the Controller of Stores (Department of Posts and Telegraphs), during the May–July period of this year :—General Chemical and Pharmaceutical Co., Ltd., Sudbury, Middlesex ; British Drug Houses, Ltd., London ; Lennox Chemicals, Ltd., Dublin ; and Chas. Tennant and Co., Ltd., Dublin. Contracts for the supply of laboratory apparatus over the same period were made with R. Ronan, Dublin ; T. H. Mason, Dublin ; J. W. Towers, Widnes ; Lennox Chemicals, Ltd., Dublin ; and Baird and Tatlock (London), Ltd., London.

ACCORDING to the returns given in the *Ministry of Labour Gazette* for September, 16,499 persons were registered as wholly unemployed on August 24 in respect of the chemical industry in Great Britain and Northern Ireland ; an additional 2,091 persons were affected by temporary stoppages. These figures do not include persons engaged in the manufacture of explosives (2,163 wholly unemployed, 621 temporary stoppages) ; paint, varnish, red and white leads (2,010 wholly unemployed, 215 temporary stoppages) ; and oil, glue, soap, ink and matches (8,009 wholly unemployed, 1,842 temporary stoppages). In comparison with figures for July 27, persons wholly unemployed in the chemical industry have increased to the extent of 5·6 per cent. ; temporary stoppages have declined 7·8 per cent.

Obituary

BERTRAM HUNT, F.I.C., M.I.M.M., eldest son of the late Edmund Hunt, of Glasgow, has died at San Francisco, U.S.A., aged 71.

PERCY GROOM, F.R.S., late professor, Imperial College of Science and Technology, South Kensington, died at Gerrard's Cross, on September 16.

MR. J. W. SLATER, B.Sc., F.I.C., of North End, of the staff of the Admiralty Chemist Department, H.M. Dockyard, Portsmouth, died suddenly on September 15.

Patent Literature

The following information is prepared from published Patent Specifications and from the Illustrated Official Journal (Patents) by permission of the Controller to H.M. Stationery Office. Printed copies of full Patent Specifications accepted may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

Abstracts of Accepted Specifications

349,586. MAKING EMULSIONS. H. T. Bohme, Akt.-Ges., 29, Moritzstrasse, Chemnitz, Germany. International Convention date, December 9, 1928.

Aqueous dispersions of alkyl and cyclo-alkyl esters of aromatic sulphonic acids, with or without sulphonated oils, soaps or fat solvents, are used as emulsifying agents for fats sizes and impuie ris.

349,655. PURIFYING CRUDE BENZINE, ETC. W. W. Triggs, London. From Ges fur Teerverwertung; Meiderich Duisburg, Germany. Application date, March 6, 1930.

Crude benzines from the distillation of coal or brown coal, or from high-temperature coking, are hydrogenated in the presence of active carbon at 100–200 atmospheres pressure and 300°–400° C., the conditions being such that no cracking takes place. Examples are given of the treatment of crude benzine from low temperature coking of gas coal, crude benzine from lignite generator tar, and crude solvent naphtha from coke oven tar, to obtain motor spirit. Reference is directed by the Comptroller to Specifications Nos. 296,429, 300,900, 327,463.

349,692. ALKALI FERRO-CYANIDES. R. Brandt, 4, Claus Grothstrasse, Bergedorf, near Hamburg, Germany. Application date, March 24, 1930.

Coal gas is freed from tar and ammonia, and is washed with a suspension of divalent iron compounds in an excess of alkali hydroxide or carbonate. The excess alkali is converted into carbonate or bicarbonate, and used for making wash liquor. The divalent iron compounds are obtained by treating ferous sulphate or chloride with milk of lime, soda, or ammonia at 80°–90° C. The spent liquor is filtered hot and concentrated to obtain water-soluble potassium and/or sodium ferrocyanides free from insoluble cyanides. In the concentration any bicarbonate is decomposed and thiocyanic acid and sulphuretted hydrogen are driven off.

349,682. TETRAZOLES. Knoll Akt.-Ges., Chemische Fabriken Akt.-Ges., Ludwigshafen-on-Rhine, Germany. International Convention date, March 14, 1929.

Pentamethylene tetrazole is obtained by treating methoxy-hexamethylene imine with hydrazoic acid, or the hydrochloride and acetate of the imino ether with sodium azide. Phenyl-tetrazole is obtained by treating benzimido-ethylether with hydrazoic acid.

349,685. ORGANO MERCURY COMPOUNDS. Johnson and Johnson (Great Britain), Ltd., Slough. From Johnson and Johnson, New Brunswick, N.J., U.S.A. Application date, March 18, 1930.

3-nitro-4-hydroxy-toluene is treated with a mercuric compound such as mercuric acetate yielding a product insoluble in water, but which may be rendered soluble by boiling with alkali which converts it into the alkali metal salt of hydroxy mercuri-3-nitro-4-hydroxy-toluene. These salts have germicidal and antiseptic properties.

349,713–4. DYES. I.G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. International Convention date, April 9, 1929.

349,713. An α-amino-anthrimido-carbazole is condensed with an anthraquinone-*o*-halogen-carboxylic acid or an ester in a high boiling organic solvent and in the presence of an acid fixing agent and a copper salt. The imides may be isolated by filtration and converted to the corresponding acridones by heating in concentrated sulphuric acid to 100° C. In an example, 4-amino-1 : 1^1-anthrimido-carbazole is condensed with anthraquinone-2-bromo-1-carboxylic acid methyl ester and the product is saponified and ring closed with sulphuric acid, yielding a dye which gives olive-green shades. Other examples are given.

349,714. Several methods are described for producing α-(β-anthraquinonoylamino)-anthrimido-carbazoles. At least one anthraquinone-β-carboxylic acid residue may be introduced into the amino groups of α-amino-anthimido-carbazoles; or the residue may be introduced into an amino-1 : 1^1-anthrimide and the product converted into the carbazole; or a halogen α-amino-anthraquinone may be treated with an anthraquinone-β-carboxylic acid halide, the product treated with an amino anthraquinone in a high boiling solvent in the presence of copper and sodium acetate, and carbazole ring formation then effected; or an α-aroyl-amino-halogen-anthraquinone may be condensed with an α-α^1-diamino-anthraquinone one amino group of which is substituted by an anthraquinone-β-carboxylic acid residue and carbazole ring formation then effected; or an α-α^1-aroyl-amino-aminoanthraquinone may be treated with a (β-anthraquinonoyl-amino) halogen-anthraquinone, and carbazole ring formation then effected. The products dye orange to olive-green shades. A number of examples are given.

349,715. REMOVING ARSENIC FROM ACIDS. A. L. Mond, London. From Metallges Akt.-Ges., Frankfort-on-Main, Germany. Application date, April 10, 1930.

The precipitation of arsenic sulphide from sulphuric acid is assisted by the presence of inert solid substances such as fine sand or alumina, gases such as nitrogen, hydrogen, oxygen or air, or liquid organic substances such as benzene together with a frothing agent such as pine oil or oil of turpentine. The additions are stirred into the solution, and the arsenic sulphide settles with the solid additions, or rises to the surface with the gas, or liquid and frothing agent.

349,771. HYDROGEN PEROXIDE. Kali-Chemie Akt.-Ges., 10, Reichstagsufer, Berlin. International Convention date, June 15, 1929.

Solutions of hydrogen peroxide are purified or stabilised by electro-osmotic treatment in the central compartment of a cell having also cathodic and anodic compartments separated by two ceramic diaphragms stable to hydrogen peroxide. The cathodic and anodic compartments contain water. Examples are given in which hydrogen peroxide solution is freed from chlorine ions and sulphate ions.

349,823. POTASSIUM AND SODIUM NITRATES, SODA AMMONIUM CHLORIDE AND DOUBLE SULPHATES. Chemieverfahren-Ges., 15, Wilhelmstrasse, Bochum, Germany. International Convention date, August 23, 1929.

Sylvinite is mixed with potassium chloride till the potassium-sodium ratio is the same as in glaserite ($3K_2SO_4.Na_2SO_4$), and then treated with ammonia and an ammonium chloride solution containing ammonium sulphate obtained in a later stage of the process. The precipitate of glaserite is treated with calcium carbonate and nitric acid to obtain a precipitate of gypsum containing double sulphates of potassium and calcium. The solution of potassium and sodium nitrates is evaporated. The glaserite mother liquor is cooled to separate part of the ammonium chloride, and treated with carbon dioxide to form ammonium carbonate which is treated with the gypsum to obtain a mixture of ammonium sulphate, ammonium chloride and calcium carbonate for use in treating a further quantity of sylvinite.

349,877. TREATING ROCK PHOSPHATE. Smeltwerk Aktieselskap and E. Johnson, Odda, Norway. International Convention date, September 28, 1929. Addition to 339,340.

Specification 339,340 (See THE CHEMICAL AGE, Vol. XXIV, p. 125), describes the treatment of rock phosphate with nitric acid and separation of the calcium nitrate. The mother liquor from a prior crystallisation is added during solution and crystallisation. In the first case, the liquor may have been used for washing or cooling the vapour driven off, and in the second case, the liquor may be cooled below the temperature of the solution to which it is added.

349,892. DESTRUCTIVE HYDROGENATION. J. Y. Johnson, London. From I.G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. Application date, March 6, 1930.

Residues from the refining of heavy mineral oils, tar oils, etc., with alkalies or from the treatment of hydrocarbons with alkalies to effect polymerisation, are destructively hydrogenated at 5–1,000 atmospheres pressure, and 370°–500° C. in the presence of compounds of the sixth group. Products of lower boiling point are obtained.

349,991. Destructive Hydrogenation. Gas Light and Coke Co. and R. H. Griffith, 84, Horseferry Road, London. Application date, January 25, 1930.

High boiling hydrocarbons are destructively hydrogenated in the presence of a molybdenum catalyst and a promoter

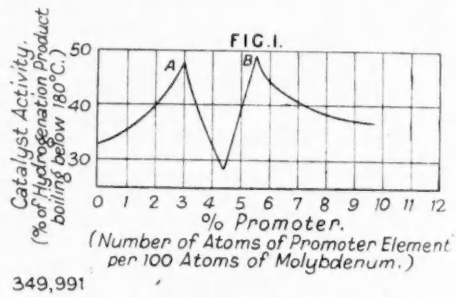


FIG. I.
Catalyst Activity. (% of Hydrogenation Product boiling below 180° C.)
50
40
30
A
B
0 1 2 3 4 5 6 7 8 9 10 11 12
% Promoter.
(Number of Atoms of Promoter Element per 100 Atoms of Molybdenum.)

349,991

such as silicon, boron, phosphorus, lithium, calcium, and the metals, alkaline earth metals, metalloids or non-metals (except sulphur) lower in atomic weight than chromium. It is found that the curve showing the relation between the atomic percentage of promoter and the percentage of hydrogenation product boiling below 180° C. shows one or more marked peaks such as A, B, and the percentage of promoter is adjusted accordingly.

349,998. Nitric and Sulphuric Acids: Ammonium Sulphate-Nitrate. Ruhrchemie Akt.-Ges., Holten, Oberhausen, Germany. International Convention date, February 23, 1929.

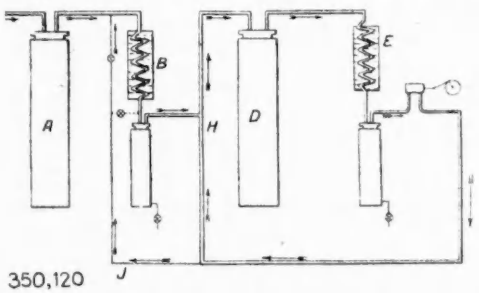
A mixture of ammonia and sulphur dioxide is oxidised and the mixture of sulphuric and nitric acids obtained is neutralised with ammonia Thus, ammonia is oxidised by a large excess of air at a platinum surface into nitrous gases, and sulphur dioxide and steam are introduced into the slightly cooled combustion gases. The mixture, together with ammonia gas, is passed into a saturated solution of ammonium sulphate and nitrate, and the mixed ammonium nitrate-sulphate separates on cooling. Some modifications of the process are described.

350,050. Sulphates. Metallges. Akt.-Ges., 45, Bockenheimer Anlage, Frankfort-on-Main, Girsewald, Conway, Baron von, 15, Marienstrasse, Frankfort-on-Main, and E. Stahl, 51, Bockenheimer Anlage, Frankfort-on-Main, Germany. Application date, March 13, 1930.

Ammonium, sodium, zinc, copper and other sulphates are obtained by treating the base in an aqueous medium with a very finely divided mixture of sulphur dioxide and oxygen, obtained by forcing it through microporous plates or tubes, or by stirring members rotating at 3,000–4,000 revs. per min. Gas obtained by roasting pyrites, zinc blende or gas purifying agents and containing less than 5 per cent. of sulphur dioxide may be used.

350,120. Ammonia Synthesis. Soc. l'Air Liquide Soc. Anon. pour l'Etude et l'Exploitation des Procédés, G. Claude, 48, Rue St. Lazare, Paris. (Assignees of Soc. Chimique de la Grande Paroisse Azote et Produits Chimiques, 40, Rue du Colisée, Paris). International Convention date, July 9, 1929.

To avoid obstruction of the pipes by ammonium carbonate formed by reaction between ammonia in the recirculated



350,120

gas and traces of carbon dioxide in the make-up gas, the latter is mixed with ammonia in the presence of sufficient moisture to dissolve the carbonate. The gases pass through a purifier A and cooler B to the reaction chamber D and ammonia is removed at E. The gas is returned to the point H, but a small proportion is passed through the pipe J to the make-up gas before this is dried in the cooler B.

350,124. Sulphur. D. Tyrer, Norton Hall, The Green, Norton-on-Tees, and Imperial Chemical Industries, Ltd., Millbank, London. Application date, April 5, 1930.

Furnace gases or gases from the roasting of sulphur ores are preheated to 300°–800° C., and then passed over coke heated above 1,000° C. The sulphur dioxide is converted into carbon monoxide and dioxide with liberation of sulphur, and some of the monoxide is converted into dioxide by adding oxygen-containing gas to the outgoing gases. The monoxide must remain in slight excess. A construction of furnace is described.

349,761. Quinoline Derivatives. Soc. of Chemical Industry in Basle, Switzerland. International Convention date, May 16, 1929.

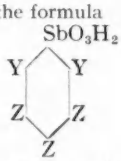
Amino-alkoxy derivatives of arylquinolines, which are water-soluble and are used for therapeutic purposes, are obtained by treating an oxyarylquinoline with an amino-alkylating agent or by treating a halogen arylquinoline with an amino alcohol, or by treating a halogen alkoxy-arylquinoline with an amine, all in presence of an acid binding agent, or by converting an amino-alkoxy aromatic compound by ring closure into the corresponding arylquinoline compound. Examples are given of the preparation of 2-phenyl-7-diethylamino-ethoxy-quinoline, 2-diethylamino-ethoxy-3-phenyl-quinoline, 2(*p*-diethylamino-ethoxy-phenyl)-quinoline, and 2-phenyl-6-piperidyl-ethoxy-4-quinoline carboxylic acid.

349,795. Dye Intermediates. I.G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. International Convention date, June 14, 1929. Addition to 267,164 and 314,028. (See The Chemical Age, Vol. XVI, p. 468, and Vol. XXI, p. 179.)

An anthraquinone-1 : 2-isoxazole is treated with aliphatic or aromatic alcohol in the absence of an alkaline agent to obtain 1-aminoanthraquinone-2-carboxylic acid esters, and examples are given of reactions with ethyl alcohol, methyl alcohol, benzyl alcohol and amyl alcohol.

349,796. Stibinic Acids. I.G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. International Convention date, June 15, 1929.

Stibinic acids having the formula



where one Y represents hydrogen and the other any substituent, and one Z represents the acylamino group, and the others represent hydrogen or any other substituent, are obtained by diazotising the corresponding 1-amino compound and treating with alkali antimonite, or by acylating the corresponding amino-stibinic acid. Several examples are given, and the preparation of the corresponding 1-amino compounds is also described.

349,872. Asymmetrical Dichlorethylene. A. L. Mond, London. From I.G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. Application date, September 17, 1930.

Asymmetrical dichlorethylene is obtained by stirring 1 : 1 : 1- or 1 : 1 : 2-trichlorethane with milk of lime for several hours, and then gradually raising the temperature and distilling off the dichlorethylene.

349,934. Indene Phenol Condensation Products. A. Carpmael, London. From I.G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. Application date, February 28, 1930. Addition to 297,075.

Specification No. 297,075 (see The Chemical Age, Vol. XIX, p. 368) describes the process for condensing indene or a derivative with a mono or polyhydric phenol in the presence of a halogen acid as a condensing agent. In this invention, any inorganic acid or acid salt is used as the condensing agent.

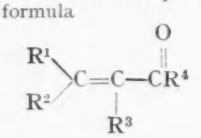
349,960. Dyeing. Imperial Chemical Industries, Ltd., Millbank, London, and R. Brightman, Crumpsall Vale Chemical Works, Blackley, Manchester. Application date, February 3, 1930.

Disazo dyes are obtained by tetrazotising 2-nitro-benzidine or 2 : 2^1-dinitro-benzidine and coupling in alkaline medium

with 1 : 5 : 7-amino-naphthol sulphonic acid or an N-substituted derivative (2 mols.), or with 1 : 5 : 7- acid or an N-substituted derivative (1 mol.) and a phenol, naphthol or pyrazolone or sulphonic or carboxylic derivative (1 mol.). These dyes give red to brown shades on regenerated cellulose.

349,976. Synthetic Rubber. A. Carpmael, London. I.G. Farbenindustrie Akt.-Ges., Frankfort-on-Main, Germany. Application date, March 5, 1930.

Diolefines or mixtures with cyclic diolefines or olefine benzenes are polymerised in the presence of unsaturated ketones having the formula



where R^1, R^2, R^3 represent hydrogen, aryl, or alkyl groups, and R^4 represents an alkyl or aryl group. In an example, butadiene is polymerised with methyl methylene-ethyl ketone and diethyl-amino-ethoxy oleyl anilide.

Specifications Accepted with Date of Application

356,106. Metallic alloys, Production of. Energy Research Co. May 30, 1929.

356,145. Extracting impurities from quartz, silicates, and particularly from clay, Process of. W. W. Triggs. (*Soc. des Produits Chimiques Alterra Soc. Anon.*) May 2, 1930.

356,166. Esters of sulphonated fatty acids, Manufacture of. A. Carpmael. (*I.G. Farbenindustrie Akt.-Ges.*) June 2, 1930.

356,172. Refining of wax containing oil by distillation. Sharples Speciality Co. June 14, 1929.

356,189. Condensation products from aromatic hydrocarbons, Manufacture of. J. Y. Johnson. (*I.G. Farbenindustrie Akt.-Ges.*) May 2, 1930.

356,190. Hydrocyanic acid, Manufacture of. Ges. fur Kohlentechnik. June 6, 1929.

356,192. Complex salts of organic compounds containing phenolic groups, Manufacture of. A. Carpmael. (*I.G. Farbenindustrie Akt.-Ges.*) May 27, 1930.

356,205. Paraffin wax from materials containing the same, Recovery of. J. Y. Johnson. (*I.G. Farbenindustrie Akt.-Ges.*) June 4, 1930. Addition to 291,817.

356,218. Sulphonic acids, Manufacture of. A. Carpmael. (*I.G. Farbenindustrie Akt.-Ges.*) June 4, 1930.

356,238. Phosphorus-halogen and phosphorus-halogen-oxygen compounds, Production of. Naamlooze Vennootschap Electrochemische Industrie. May 30, 1929.

356,264. Articles made from steel alloys capable of resisting chemical attack. F. Krupp Akt.-Ges. and H. Koppers Akt.-Ges. June 13, 1929.

356,283. Sulphate of ammonia, Manufacture of. H. J. Hodsman and A. Taylor. May 30, 1930.

356,290. Electrolytic production of aluminium alloys. D. R. Tullis and P. Oakley. January 28, 1931.

356,380. Separation of beryllium compounds from minerals or substances containing beryllium by chlorination. W. Kangro and A. Lindner. July 30, 1929.

356,384. Phosphatides, Production and purification of. H. Bollman. October 21, 1929.

356,408. Highly viscous solutions from polyvinyl alcohols, Manufacture of. I.G. Farbenindustrie Akt.-Ges. July 29, 1929.

356,508. Colour lakes, Manufacture of. J. Y. Johnson. (*I.G. Farbenindustrie Akt.-Ges.*) September 29, 1930.

356,523. Iron and iron compounds from substances containing iron, Removal of. J. Y. Johnson. (*I.G. Farbenindustrie Akt.-Ges.*) October 6, 1930.

356,534. Removing of strata of adsorption media from adsorption apparatus. Metallges. Akt.-Ges. October 18, 1929.

356,550. Fat-soluble salts of bismuth, Preparation of. Laboratoire Francais de Chimiotherapie and A. Girard. October 24, 1930.

356,580. Ammonium sulphate, Manufacture of. F. A. F. Pallemaerts and Union Chimique Belge Soc. Anon. November 27, 1930.

356,600. Purifying lactic acid, Process for. R. Von Wulfing and E. Moller (trading as A. Wulfing (firm of)), and H. Umber. December 10, 1930.

356,603. 1 : 3-butyleneglycol, Production of. Lonza Elektrizitatswerke und Chemische Fabriken Akt.-Ges. December 13, 1929.

356,606. Higher aliphatic alcohols, Preparation of. H. T. Bohme Akt.-Ges. January 27, 1930.

356,609. Diacetone alcohol, Manufacture of. Usines de Melle. January 4, 1930.

356,624. Fertilisers, Manufacture of. Soc. d'Etudes Scientifiques et d'Entreprises Industrielles. February 6, 1930. Addition to 342,931.

356,627. Leaching phosphate rock. Kunstdunger-Patent-Verwertungs Akt.-Ges. February 13, 1930.

356,645. Ammonia, Manufacture of—by the contact process. A. Mentzel. February 16, 1931.

Applications for Patents

[*In the case of applications for patents under the International Convention, the priority date (that is, the original application date abroad which the applicant desires shall be accorded to the patent) is given in brackets, with the name of the country of origin. Specifications of such applications are open to inspection at the Patent Office on the anniversary of the date given in brackets, whether or not they have been accepted.*]

Apex (British) Artificial Silk, Ltd., and Baines, L. Manufacture of cellulose acetate. 26,267. September 19.

Blagden, J. W., Howards and Sons, Ltd., and Huggett, W. E. Manufacture of crystalline menthol. 26,077. September 17.

Bleachers' Association, Ltd., Farrington, F., Parker, C. S., and Wall, C. L. Dyeing. 26,233. September 19.

Carpmael, A. (*I.G. Farbenindustrie Akt.-Ges*). Manufacture of azo dyestuff, etc. 25,739. September 14.

—— Manufacture of styrene derivatives. 26,103. September 17.

Chemical Engineering and Wilton's Patent Furnace Co., Ltd., Green, H. E. J., and Wilton, T. O. Manufacture of sulphate of ammonia. 26,277. September 19.

Chemische Fabrik Budenheim Akt.-Ges. Production of tri-sodium phosphate. 25,758. September 14. (Germany, September 24, 1930.)

Compagnie Nationale de Matières Colorantes et Manufactures de Produits Chimiques du Nord Réunies, Etablissements Kuhlmann. Manufacture of new products. 26,105. September 17. (France June 30.)

Courtaulds, Ltd., and Hegan, H. J. Removal of sodium sulphate from solutions. 26,257. September 19.

Dehn, F. B. (Deutsche Hydrierwerke Akt.-Ges.). Manufacture of products for use as substitutes for neats-foot oil. 25,870. September 15.

(Deutsche Gold-und Silber-Scheideanstalt vorm. Roessler), Elkington, H.D. Process for dehydration of water-containing alkali hydroxides. 25,932. September 16.

Du Pont du Nemours and Co., E. I. Production of *o*-amino-aryl mercaptans, etc. 26,115. September 17. (United States, September 17, 1930.)

Fairweather, D. A. W. Dyes, etc. 26,079. September 17.

Forwood, G. F., and United Kingdom Oil Co., Ltd. Catalysts for conversion of hydrocarbons to lighter hydrocarbons. 25,862. September 15.

Groves, W. W. (*I.G. Farbenindustrie Akt.-Ges.*) Manufacture of insoluble azo-dyestuffs on the fibre. 25,951. September 16.

—— Manufacture of 1 : 6-dibromo-2-hydroxy-naphthalene-3-carboxylic acid. 26,076. September 17.

Horsley, G. F., and Imperial Chemical Industries, Ltd. Production of alcohols from corresponding olefines. 25,887. September 15.

Imperial Chemical Industries, Ltd. Welding. 25,757. September 14.

—— Production of fertilisers. 25,886. September 15.

—— and Thomson, R. F. Production of chemical compounds. 26,078. September 17.

—— and Thomson, R. F. Dyes, etc. 26,079. September 17.

—— and Prince, A. J. Production of fertilisers. 26,080. September 17.

Johnson, J. Y. (*I.G. Farbenindustrie Akt.-Ges.*) Manufacture of organic sulpho-halides. 25,702. September 14.

——, Mond, A. L. Production of vat dyestuffs of the anthraquinone series. 25,760. September 14.

——, Johnson, J. Y. Manufacture of thermoplastic polymerisation products. 25,847. September 15

——, Johnson, J. Y. Oxidation of organic compounds. 25,961. September 16

—— Manufacture of condensation products of amino substituted arseno compounds. 26,178. September 18. (Germany, September 20, 1930.)

Laporte, B., Ltd., Slater, V. W., and Weber, E. Manufacture of hydrogen peroxide. 25,950. September 16.

Löfquist, H. Metallurgical concentration of raw material. 26,102. September 17.

Monsanto Chemical Works. Manufacture of esters of phosphoric acid. 25,725. September 14. (United States, September 29, 1930.)

Prince, A. J. Production of fertilisers. 25,886. September 15.

Salerni, P. M. Low-temperature carbonisation, etc. 26,113. September 17.

—— Retorts, furnaces, etc. 26,215. September 18.

Semple, G. C. Production of chemical compounds. 26,078. September 17.

Vineyardists, Inc. Process for removing tartaric acid, etc., from grape juice, etc. 25,731. September 14. (United States, September 20, 1930.)

Weekly Prices of British Chemical Products

The prices and comments given below respecting British chemical products are based on direct information supplied by the British manufacturers concerned. Unless otherwise qualified, the figures quoted apply to fair quantities, net and naked at makers' works.

General Heavy Chemicals

ACID ACETIC, 40% TECH.—£17 15s. per ton d/d address U.K. in casks.
ACID CHROMIC.—11d. per lb., less 2½% d/d U.K.
ACID HYDROCHLORIC.—Spot, 3s. 9d. to 6s. carboy d/d, according to purity, strength and locality.
ACID NITRIC, 80° Tw.—Spot, £20 to £25 per ton makers' works, according to district and quality.
ACID SULPHURIC.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations; 140° Tw., Crude acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
AMMONIA (ANHYDROUS).—Spot, 10d. per lb., d/d in cylinders.
AMMONIUM BICHROMATE.—8½d. per lb. d/d U.K.
BISULPHITE OF LIME.—£7 10s. per ton, f.o.r. London, packages free.
BLEACHING POWDER, 35/37%.—Spot, £7 10s per ton d/d station in casks, special terms for contracts.
BORAX, COMMERCIAL.—Crystals, £13 10s. per ton: granulated, £12 10s. per ton; powder, £14 per ton. (Packed in 1 cwt. bags. carriage paid any station in Great Britain. Prices quoted are for one ton lots and upwards.)
CALCIUM CHLORIDE (SOLID), 70/75%.—Spot, £4 15s. to £5 5s. per ton d/d station in drums.
CHROMIUM OXIDE.—9d. to 9½d. per lb. according to quantity d/d U.K.
CHROMETAN.—Crystals, 3½d. per lb. Liquor, £18 12s. 6d. per ton d/d U.K.
COPPER SULPHATE.—£25 to £25 10s. per ton.
METHYLATED SPIRIT 61 O.P.—Industrial, 1s.11d. to 2s.4d. per gall.; pyridinised industrial, 2s. 1d. to 2s. 6d. per gall.; mineralised, 3s. to 3s. 4d. per gall. 64 O.P., 1d. extra in all cases. Prices according to quantity.
NICKEL SULPHATE.—£38 per ton d/d.
NICKEL AMMONIA SULPHATE.—£38 per ton d/d.
POTASH CAUSTIC.—£30 to £33 per ton.
POTASSIUM BICHROMATE CRYSTALS AND GRANULAR.—4½d. per lb. nett d/d U.K., discount according to quantity; ground ½d. per lb. extra.
POTASSIUM CHLORATE.—3¾d. per lb. ex-wharf, London, in cwt. kegs.
POTASSIUM CHROMATE.—8½d. per lb. d/d U.K.
SALAMMONIAC.—Firsts lump, spot, £40 17s. 6d. per ton d/d address in barrels. Chloride of ammonia, £37 to £45 per ton, carr. paid.
SALT CAKE, UNGROUND.—Spot, £3 10s. per ton d/d station in bulk.
SODA ASH, 58%.—Spot, £6 per ton, f.o.r. in bags, special terms for contracts.
SODA CAUSTIC, SOLID, 76/77°E.—Spot, £14 10s. per ton, d/d station.
SODA CRYSTALS.—Spot, £5 to £5 5s. per ton, d/d station or ex depot in 2-cwt. bags.
SODIUM ACETATE 97/98%.—£21 per ton.
SODIUM BICARBONATE, REFINED.—Spot, £10 10s. per ton d/d station in bags.
SODIUM BICHROMATE CRYSTALS (CAKE AND POWDER)—3½d. per lb. nett d/d U.K., discount according to quantity. Anhydrous ¾d. per lb. extra.
SODIUM BISULPHITE POWDER, 60/62%.—£16 10s. per ton delivered 1-cwt. iron drums for home trade.
SODIUM CHLORATE.—2¾d. per lb.
SODIUM CHROMATE.—3¾d. per lb. d/d U.K.
SODIUM NITRITE.—Spot, £19 per ton, d/d station in drums.
SODIUM PHOSPHATE.—£14 per ton, f.o.r. London, casks free.
SODIUM SILICATE, 140° Tw.—Spot, £8 5s. per ton, d/d station returnable drums.
SODIUM SULPHATE (GLAUBER SALTS).—Spot, £4 2s. 6d. per ton, d/d.
SODIUM SULPHIDE SOLID, 60/62%.—Spot, £10 5s. per ton, d/d in drums. Crystals—Spot, £8 5s. per ton, d/d in casks.
SODIUM SULPHITE, PEA CRYSTALS.—Spot, £13 10s. per ton, d/d station in kegs. Commercial—Spot, £9 per ton, d/d station in bags.

Coal Tar Products

ACID CARBOLIC CRYSTALS.—4¾d. to 6½d. per lb. Crude 60's 1s. to 1s. 1d. per gall. August/December.
ACID CRESYLIC 99/100.—1s. 8d. to 1s.9d. per gall. B.P., 3s. 6d. per gall. 97/99.—Refined, 1s. 11d. to 2s. 2d. per gall. Pale, 98%, 1s. 7d. to 1s. 8d. Dark, 1s. 4d. to 1s. 4½d.
ANTHRACENE OIL, STRAINED (GREEN OIL).—4½d. to 4¾d. per gall.
BENZOLE.—Prices at works: Crude, 7d. to 7½d. per gall.; Standard Motor, 1s. 2d. to 1s. 3d. per gall. 90%.—1s. 3d. to 1s. 4d. per gall. Pure, 1s. 6d. to 1s. 7d. per gall.
TOLUOLE.—90%, 1s. 9d. to 1s. 10d. per gall. Pure, 1s. 11d. to 2s. per gall.
XYLOL.—1s. 8d. to 1s. 9d. per gall. Pure, 1s. 11d. to 2s. per gall.
CREOSOTE.—Standard specification, for export, 4¾d. to 5d. net per gall. f.o.b.; for Home, 3¾d. per gall. d/d.
NAPHTHA.—Solvent, 90/160, 1s. 3d. per gall. Solvent, 95/160, 1s. 5d. to 1s. 6d. per gall. Solvent, 90/190, 1s. to 1s. 5d. per gall.
NAPHTHALENE.—Purified Crystals, £10 per ton, in bags.
PITCH.—Medium soft, 52s. 6d. per ton, in bulk at makers' works.
PYRIDINE.—90/140, 3s. to 3s. 3d. per gall. 90/160, 3s. 3d. to 3s. 6d. per gall. 90/180, 1s. 9d. to 2s. per gall.

Intermediates and Dyes

In the following list of Intermediates delivered prices include packages except where otherwise stated:—

ACID GAMMA.—Spot, 3s. 3d. per lb. 100% d/d buyer's works.
ACID H.—Spot, 2s. 3d. per lb. 100% d/d buyer's works.
ACID NAPHTHIONIC.—1s. 2d. per lb. 100% d/d buyer's works.
ACID NEVILLE AND WINTHER.—Spot, 2s. 6d. per lb. 100% d/d buyer's works.
ACID SULPHANILIC.—Spot, 8½d. per lb. 100% d/d buyer's works.
ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.
ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.
BENZALDEHYDE.—Spot, 1s. 6d. per lb., packages extra, d/d buyer's works.
BENZIDINE BASE.—Spot, 2s. 3d. per lb. 100% d/d buyer's works.
o-CRESOL 30/31° C.—£2 6s. 5d. per cwt., in 1-ton lots.
m-CRESOL 98/100%.—2s. 9d. per lb., in ton lots.
p-CRESOL 34·5° C.—1s. 9d. per lb., in ton lots.
DICHLORANILINE.—2s. 5d. per lb.
DIMETHYLANILINE.—Spot, 1s. 6d. per lb., packages extra, d/d buyer's works.
DINITROBENZENE.—7½d. per lb.
DINITROTOLUENE.—48/50° C., 7d. per lb.; 66/68° C., 7¾d. per lb.
DIPHENYLAMINE.—Spot, 1s. 8d. per lb. d/d buyer's works.
a-NAPHTHOL.—Spot, 1s. 9d. per lb. d/d buyer's works.
B-NAPHTHOL.—Spot, £65 per ton in 1 ton lots, d/d buyer's works.
a-NAPHTHYLAMINE.—Spot, 10½d. per lb. d/d buyer's works.
B-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb. d/d buyer's works.
o-NITRANILINE.—5s. 11d. per lb.
m-NITRANILINE.—Spot, 2s. 6d. per lb. d/d buyer's works.
p-NITRANILINE.—Spot, 1s. 8d. per lb. d/d buyer's works.
NITROBENZENE.—Spot, 6½d. per lb., 5-cwt. lots, drums extra, d/d buyer's works.
NITRONAPHTHALENE.—8½d. per lb.
SODIUM NAPHTHIONATE.—Spot, 1s. 6d. per lb. 100% d/d buyer's works.
o-TOLUIDINE.—Spot, 9½d. per lb., drums extra, d/d buyer's works.
p-TOLUIDINE.—Spot, 1s. 6d. per lb. d/d buyer's works.
m-XYLIDINE ACETATE.—3s. 3d. per lb., 100%.

Wood Distillation Products

ACETATE OF LIME.—Brown, £6 10s. to £7 10s. per ton. Grey, £11 to £13 per ton. Liquor, 7d. to 9d. per gall.
ACETIC ACID, TECHNICAL, 40%.—£15 15s. per ton.
ACETONE.—£63 to £65 per ton.
AMYL ACETATE, TECHNICAL.—85s. to 95s. per cwt.
CHARCOAL.—£5 10s. to £9 per ton, according to grade and locality.
IRON LIQUOR.—24°/30° Tw., 9d. to 1s. 2d. per gall.
METHYL ACETONE, 40/50%.—£43 per ton.
RED LIQUOR.—16° Tw., 7½d. to 9d. per gall.
WOOD CREOSOTE.—9d. to 1s. 6d. per gall., unrefined.
WOOD NAPHTHA, MISCIBLE.—2s. 4d. to 3s. per gall., according to quantity. Solvent, 3s. 6d. to 4s. per gall.
WOOD TAR.—£4 to £6 per ton.
BROWN SUGAR OF LEAD.—£30 to £32 per ton.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 6d. to 1s. 1d. per lb., according to quality; Crimson, 1s. 3d. to 1s. 5d. per lb., according to quality.
ARSENIC SULPHIDE, YELLOW.—1s. 5d. to 1s. 7d. per lb.
BARYTES.—£6 to £7 10s. per ton, according to quality.
CADMIUM SULPHIDE.—3s. 3d. to 3s. 6d. per lb.
CARBON BISULPHIDE.—£26 to £28 per ton, according to quantity; drums extra.
CARBON BLACK.—3d. to 4d. per lb., ex wharf.
CARBON TETRACHLORIDE.—£40 to £50 per ton, according to quantity drums extra.
CHROMIUM OXIDE, GREEN.—1s. 2d. per lb.
DIPHENYLGUANIDINE.—2s. 6d. per lb.
INDIARUBBER SUBSTITUTES, WHITE.—4d. to 5½d. per lb.; Dark, 4d. to 4½d. per lb.
LAMP BLACK.—£27 per ton.
LITHOPONE, 30%.—£18 to £20 per ton.
SULPHUR.—£9 10s. to £13 per ton.
SULPHUR CHLORIDE.—4d. to 7d. per lb., according to quality.
SULPHUR PRECIP. B.P.—£55 to £60 per ton, according to quantity.
SULPHUR PRECIP. COMMERCIAL.—£40 to £45 per ton.
VERMILION, PALE OR DEEP.—6s. 2d. to 6s. 8d. per lb.
ZINC SULPHIDE.—8d. to 11d. per lb.

Pharmaceutical and Photographic Chemicals

ACETANILIDE.—1s. 4d. to 1s. 6d. per lb.

ACID, ACETIC, PURE, 80%.—£35 5s. per ton d/d address U.K. in casks.

ACID, ACETYL SALICYLIC.—2s. 7d. to 2s. 9d. per lb., according to quantity.

ACID, BENZOIC B.P.—1s. 10d. per lb., for synthetic product. Solely ex Gum, 1s. 3d. to 1s. 6d. per oz.; 50-oz. lots, 1s. 3d. per oz.

ACID, BORIC B.P.—Crystal, £31 per ton; powder, £32 per ton; For one-ton lots and upwards. Packed in 1-cwt. bags carriage paid any station in Great Britain.

ACID, CAMPHORIC.—19s. to 21s. per lb.

ACID, CITRIC.—10½d. per lb., less 5%.

ACID, GALLIC.—2s. 11d. per lb. for pure crystal, in cwt. lots.

ACID, MOLYBDIC.—5s. 3d. per lb. in ¼-cwt. lots. Packages extra. Special prices for quantities and contracts.

ACID, PYROGALLIC, CRYSTALS.—7s. 3d. per lb. for 28-lb. lots; Resublimed, 8s. 6d. per lb. for 28-lb. lots, d/d.

ACID, SALICYLIC, B.P. PULV.—1s. 5d. to 1s. 8d. per lb. Technical.—1s. to 1s. 2d. per lb.

ACID, TANNIC B.P.—2s. 8d. to 2s. 10d. per lb.

ACID, TARTARIC.—10½d. per lb., less 5%.

AMIDOL.—7s. 6d. to 11s. 3d. per lb., according to quantity.

AMMONIUM BENZOATE.—3s. 6d. per lb.

AMMONIUM CARBONATE B.P.—£36 per ton. Powder, £39 per ton in 5-cwt. casks. Resublimated, 1s. per lb.

AMMONIUM MOLYBDATE.—4s. 9d. per lb. in ¼-cwt. lots. Packages extra. Special prices for quantities and contracts.

ATROPHINE SULPHATE.—7s. to 7s. 6d. per oz., according to quantity.

BARBITONE.—5s. 9d. to 6s. per lb.

BENZONAPHTHOL.—2s. 10d. per lb.

BISMUTH CARBONATE.—6s. 3d. per lb.

BISMUTH CITRATE.—7s. 4d. per lb.

BISMUTH SALICYLATE.—6s. 11d. per lb.

BISMUTH SUBNITRATE.—5s. 6d. per lb.

BISMUTH NITRATE.—Cryst. 4s. 8d. per lb.

BISMUTH OXIDE.—9s. 4d. per lb.

BISMUTH SUBCHLORIDE.—9s. 1d. per lb.

BISMUTH SUBGALLATE.—7s. per lb. Extra and reduced prices for smaller and larger quantities of all bismuth salts respectively.

BISMUTHI ET AMMON LIQUOR.—Cit. B.P. in W. Qts. 1s. 2d. per lb.; 6 W. Qts. 11½d. per lb.; 12 W. Qts. 10d. per lb.; 36 W. Qts. 9½d. per lb. Liquor Bismuth B.P., in W. Qts., 1s. 2d. per lb.; 6 W. Qts., 11½d. per lb.; 12 W. Qts., 10d. per lb.; 36 W. Qts., 9½d. per lb.

BORAX B.P.—Crystal, £21 10s. per ton; powder, £22 per ton; for one-ton lots and upwards. Packed in 1-cwt. bags carriage paid any station in Great Britain.

BROMIDES.—Ammonium, 1s. 9d. per lb.; potassium, 1s. 4½d. per lb.; granular, 1s. 5d. per lb.; sodium, 1s. 7d. per lb. Prices for 1-cwt. lots.

CAFFEIN, PURE.—6s. 6d. per lb.

CAFFEIN CITRAS.—5s. per lb.

CALCIUM LACTATE.—B.P., 1s. 1½d. to 1s. 3d. per lb., according to quantity.

CAMPHOR.—Refined flowers, 2s. 8d. to 2s. 10d. per lb., according to quantity; also special contract prices.

CHLORAL HYDRATE.—2s. 11½d. to 3s. 1½d. per lb.

CHLOROFORM.—2s. 4d. per lb.

ETHERS.—S.G. ·730—1s. 1d. to 1s. 2d. per lb., according to quantity; other gravities at proportionate prices.

FORMALDEHYDE, 40%.—30s. per cwt., in barrels, ex wharf.

GLUCOSE, MEDICINAL.—1s. 6d. to 2s. per lb. for large quantities.

HEXAMINE.—1s. 10d. to 2s. per lb., according to quantity.

HYDROGEN PEROXIDE (12 VOLS.).—1s. 4d. per gallon, f.o.r. makers' works, naked. B.P., 10 vols., 2s. to 2s. 3d. per gall.; 20 vols., 3s. per gall.

HYDROQUINONE.—4s. 7d. per lb. in 1-lb. lots; 3s. 5½d. per lb. in cwt. lots.

HYPOPHOSPHITES.—Calcium, 2s. 11d. to 3s. 4d. per lb.; potassium, 3s. 2d. to 3s. 7d. per lb.; sodium, 3s. 1d. to 3s. 6d. per lb.; for 28-lb. lots.

IRON AMMONIUM CITRATE.—B.P., 1s. 9d. per lb., for 28-lb. lots. Green, 2s. 6d. per lb., list price. U.S.P., 2s. 7d. per lb. list price.

IRON PERCHLORIDE.—18s. to 20s. per cwt., according to quantity.

IRON QUININE CITRATE.—B.P., 8½d. to 8¾d. per oz.

MAGNESIUM CARBONATE.—Light B.P., 36s. per cwt.

MAGNESIUM OXIDE.—Light Commercial, £62 10s. per ton, less 2½%; Heavy commercial, £21 per ton, less 2½%; in quantity lower; Heavy Pure, 2s. to 2s. 3d. per lb.

MENTHOL.—A.B.R. recrystallised B.P., 13s. 6d. per lb. net; Synthetic, 8s. 6d. to 12s. per lb.; Synthetic detached crystals, 8s. 6d. to 9s. 9d. per lb., according to quantity; Liquid (95%), 8s. per lb.

MERCURIALS B.P.—Up to 1-cwt. lots, Red Oxide, crystals, 7s 4d. to 7s. 5d. per lb., levig., 6s. 11d. to 7s. per lb.; Corrosive Sublimate, Lump, 5s. 10d. to 5s. 11d. per lb., Powder, 5s. 3d. to 5s. 4d. per lb.; White Precipitate, Lump, 5s. 10d. to 5s. 11d. per lb., Powder, 5s. 11d. to 6s. per lb.; Calomel, 6s. 3d. to 6s. 4d. per lb.; Yellow Oxide, 6s. 9d. to 6s. 10d. per lb.; Persulph, B.P.C., 6s. 1d. to 6s. 2d. per lb.; Sulph. nig., 6s. 5d. to 6s. 6d. per lb. Special prices for larger quantities.

METHYL SALICYLATE.—1s. 3d. to 1s. 4d. per lb.

PARAFORMALDEHYDE.—1s. 6d. per lb.

PARALDEHYDE.—1s. 1d. per lb.

PHENACETIN.—3s. 9d. to 4s. 1d. per lb.

PHENOLPHTHALEIN.—5s. to 5s. 2½d. per lb.

POTASSIUM BITARTRATE 99/100% (Cream of Tartar).—75s. per cwt., less 2½ per cent.

POTASSIUM CITRATE.—B.P., 1s. 7d. per lb. for 28-lb. lots.

POTASSIUM FERRICYANIDE.—1s. 7½d. per lb., in 125-lb. kegs.

POTASSIUM IODIDE.—16s. 8d. to 17s. 9d. per lb., as to quantity.

POTASSIUM METABISULPHITE.—50s. per cwt. d/dLondon, kegs free.

POTASSIUM PERMANGANATE.—B.P. crystals, 5½d. per lb., spot.

QUININE SULPHATE.—1s. 8d. per oz. for 1,000-oz. lots.

SACCHARIN.—43s. 6d. per lb.

SALICIN.—16s. 6d. to 17s. 6d. per lb., according to quantity.

SILVER NITRATE.—10d. per oz. for 500-oz. lots, sticks, 2d. per oz. extra.

SODIUM BARBITONUM.—8s. 6d. to 9s. per lb. for 1-cwt. lots.

SODIUM BENZOATE B.P.—1s. 6d. to 1s. 7½d. per lb.

SODIUM CITRATE.—B.P.C. 1911, 1s. 4d. per lb. B.P.C. 1923, and U.S.P., 1s. 8d. per lb. for 28-lb. lots.

SODIUM HYPOSULPHITE, PHOTOGRAPHIC.—£15 per ton, d/d consignee's station in 1-cwt. kegs.

SODIUM NITROPRUSSIDE.—16s. per lb.

SODIUM POTASSIUM TARTRATE (ROCHELLE SALT).—75s. per cwt. net. Crystals, 2s. 6d. per cwt. extra.

SODIUM SALICYLATE.—Powder, 1s. 10d. to 2s. 2d. per lb. Crystal, 1s. 11d. to 2s. 3d. per lb.

SODIUM SULPHIDE, PURE RECRYSTALLISED.—10d. to 1s. 2d. per lb.

SODIUM SULPHITE, ANHYDROUS.—£26 to £28 per ton, according to quantity. Delivered U.K.

STRYCHNINE, ALKALOID CRYSTAL, 2s. per oz.; hydrochloride, 1s. 9½d. per oz.; nitrate, 1s. 8d. per oz.; sulphate, 1s. 9d. per oz., for 1,000-oz. quantities.

TARTAR EMETIC, B.P.—Crystal or powder, 1s. 9d. to 2s. per lb.

THYMOL.—Puriss, 6s. 1½d. to 7s. per lb., according to quantity. Natural, 12s. per lb.

ZINC STEARATE.—1s. 4d. to 1s. 6d. per lb.

Perfumery Chemicals

ACETOPHENONE.—7s. per lb.

AUBEPINE (EX ANETHOL).—8s. 9d. per lb.

AMYL ACETATE.—2s. 3d. per lb.

AMYL BUTYRATE.—4s. 9d. per lb.

AMYL CINNAMIC ALDEHYDE.—8s. 6d. per lb.

AMYL SALICYLATE.—2s. 6d. per lb.

ANETHOL (M.P. 21/22° C.).—5s. per lb.

BENZALDEHYDE FREE FROM CHLORINE.—2s. 6d. per lb.

BENZYL ACETATE FROM CHLORINE-FREE ALCOHOL.—1s. 9d per lb.

BENZYL ALCOHOL FREE FROM CHLORINE.—1s. 9d. per lb.

BENZYL BENZOATE.—2s. 2d. per lb.

CINNAMIC ALDEHYDE NATURAL.—10s. 6d. per lb.

COUMARIN.—12s. per lb.

CITRONELLOL.—7s. 3d. per lb.

CITRAL.—6s. per lb.

ETHYL CINNAMATE.—6s. 9d. per lb.

ETHYL PHTHALATE.—2s. 6d. per lb.

EUGENOL.—7s. 6d. per lb.

GERANIOL.—6s. to 10s. per lb.

GERANIOL (FROM PALMAROSA).—14s. per lb.

HELIOTROPINE.—5s. 6d. per lb.

ISO EUGENOL.—9s. per lb.

LINALOL (EX BOIS DE ROSE).—5s. 6d. per lb.

LINALYL ACETATE, EX BOIS DE ROSE.—7s. 6d. per lb. Ex Shui Oil, 7s. 6d. per lb.

METHYL ANTHRANILATE.—6s. per lb.

METHYL BENZOATE.—4s. 3d. per lb.

MUSK XYLOL.—6s. 6d. per lb.

PHENYL ETHYL ACETATE.—10s. per lb.

PHENYL ETHYL ALCOHOL.—8s. 3d. per lb.

RHODINOL.—40s. per lb.

SAFROL—1s. 6d. per lb.

VANILLIN, EX CLOVE OIL.—14s. 6d. to 16s. 6d. per lb. Ex Guaiacol.—13s. to 15s. per lb.

Essential Oils

ANISE OIL.—2s. 4d. per lb.

BERGAMOT OIL.—7s. 9d. per lb.

BOURBON GERANIUM OIL.—17s. per lb.

CAMPHOR OIL.—White, 75s. per cwt.; Brown, 75s. per cwt.

CANANGA.—Java, 7s. per lb.

CINNAMON OIL LEAF.—4s. per oz.

CITRONELLA OIL.—Java, 2s. 6d. per lb., c.i.f. Pure Ceylon, 2s. per lb.

CLOVE OIL, 90/92%.—6s. per lb.

EUCALYPTUS OIL, AUSTRALIAN, B.P. 70/75%—1s. 4d. per lb.

LAVENDER OIL.—Mont Blanc, 38/40%, 9s. per lb.

LEMON OIL.—4s. 3d. per lb.

LEMONGRASS OIL.—2s. 9d. per lb.

ORANGE, SWEET.—7s. 3d. per lb.

OTTO OF ROSE.—Anatolian, 40s. per oz.; Bulgarian, 60s. per oz.

PALMA ROSA.—8s. 3d. per lb.

PEPPERMINT.—Wayne County, 7s. 3d. per lb.; Japanese, 4s. 6d. per lb.

PETITGRAIN.—5s. per lb.

SANDALWOOD.—Mysore, 28s. 6d. per lb.

London Chemical Market

The following notes on the London Chemical Market are specially supplied to* THE CHEMICAL AGE *by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., and may be accepted as representing these firms' independent and impartial opinions.

London, September 24, 1931.

THE departure in this country of the gold standard has thrown the markets into a state of disorganisation. Prices of most chemicals are nominal and in a number of cases show already considerable advances. The tendency of the present position seems to lead inevitably toward a higher standard of values.

General Chemicals

ACETONE.—In good demand, price nominal at £60 per ton.

ACID, ACETIC.—In fair demand, price unchanged.

ACID, FORMIC.—Unchanged.

ACID, CITRIC.—Has advanced in price, level to-day being 10½d. to 11d. per lb.

ACID, OXALIC.—Has a firm market at £34 per ton in casks.

ACID, TARTARIC.—Has advanced in price, is active and firm at 10½d. to 10¾d. per lb., less 5%.

ALUMINA SULPHATE.—Market nominal.

CREAM OF TARTAR.—Has advanced in price, being to-day 78s. to 80s. per cwt., less 2½%.

FORMALDEHYDE.—Has a firm market, price £27/28 per ton.

LEAD ACETATE.—All prices withdrawn.

LITHOPONE.—Nominal, £18/22 per ton.

POTASSIUM BICHROMATE.—Firm, with upward tendency at 4¼d. per lb.

PERMANGANATE OF POTASH.—Higher in price at 5½d. per lb.

SODA BICHROMATE.—The market is unchanged for small spot sales, with a rising tendency for forward contracts.

TARTAR EMETIC.—Higher at 10¾d. per lb.

Coal Tar Products

THERE is a tendency for the prices of coal tar products to harden, but until later, no definite prices can be quoted, owing to the financial crisis and the present state of uncertainty. The last market prices are unchanged, as below :—

MOTOR BENZOL.—Quoted at about 1s. 4½d. to 1s. 5½d. per gallon, f.o.r.

SOLVENT NAPHTHA.—Quoted at about 1s. 1½d. to 1s. 2d. per gallon, f.o.r.

HEAVY NAPHTHA.—Quoted at about 11d. to 1s. 0½d. per gallon f.o.r.

CREOSOTE OIL.—Quoted at about 3d. to 3½d. per gallon f.o.r. in the North, and at about 4d. to 4½d. per gallon in London.

CRESYLIC ACID.—Quoted at about 1s. 6d. per gallon f.o.r. for the 98/100% quality, and at about 1s. 4d. per gallon for the dark quality 95/97%.

NAPHTHALENES.—Quoted at about £2 5s. to £2 10s. per ton for the firelighter quality, at about £2 15s. to £3 per ton for the 76/78 quality, and at about £4 per ton for the 76/78 quality.

PITCH.—Quoted at 47s. 6d. to 50s. per ton f.o.b. East Coast port.

THE following additional market conditions are reported :—

Carbolic Acid.—Prices are unchanged—5-ton lots at 5½d. with smaller quantities still quoted at 6¼d. per lb. in bulk packing.

Aspirin.—Remains unchanged at 2s. 7d. to 2s. 9d. per lb., according to quantity.

Methyl Salicylate.—While there has been some cheap selling for imported material, home makers' prices are unchanged, 1-ton lots 1s. 3d., 1-cwt. lots 1s. 3½d., smaller quantities, 1s. 4d.

Cresylic Acid.—Continues in fairly steady demand with prices mostly unchanged. Pale 97/99% is 1s. 6d. to 1s. 7d., and pure grades 99/100% are quoted at 1s. 10d. to 2s. Special grades 2s. 2d. to 2s. 4d. Prices are naked at works.

High Boiling Acid.—Supplies are exceedingly difficult to obtain and prices are firm with an upward tendency. There is little prospect of making any definite forecast of future trend of prices on account of the present financial situation. It is generally felt, however, that conditions have been sufficiently competitive to have brought prices down to bed-rock but that an upward movement is the logical conclusion.

Nitrogen Fertilisers

Sulphate of Ammonia.—Export.—The market for sulphate of ammonia has become firmer and the price has advanced to about £5 per ton f.o.b. U.K. port in single bags. The transactions during the week appear to have been small. *Home.*—In the home market, British producers have advanced the price to £6 5s. per ton, for delivery between now and June next, in six ton lots to consumers' nearest stations. Previously the price was at an unremunerative level and many of the by-product producers were compelled to close down.

Nitrate of Soda.—The prices reported in our last issue are still in force. We have not had any report of sales up to the present.

Latest Oil Prices

LONDON, September 23.—LINSEED OIL was strong. Spot, ex mill, £18; October, £15 10s.; October-December, £15 12s. 6d.; January-April, £16 15s.; May-August, £17 10s., naked. RAPE OIL was nominal. Crude extracted, £27; technical refined, £28 10s., naked, ex wharf. COTTON OIL was very firm. Egyptian crude, £19 10s.; refined common edible, £23 5s.; deodorised, £25 5s., naked, ex mill. TURPENTINE was firm. American, spot, 49s. 6d.; October-December, 41s. 9d. per cwt.

HULL.—LINSEED OIL. Spot and September, £16; October-December, £16 2s. 6d.; January-April, £16 15s.; and May-August, nominal, per ton, naked. COTTON OIL.—Bombay crude, spot, unquoted; Egyptian crude, spot, £20 10s.; edible refined, spot, and technical, spot £23; deodorised, spot, £25 per ton, naked. CASTOR OIL.—Pharmacy, spot, 42s. 6d.; first, 37s. 6d.; second, 35s. 6d. per cwt. PALM KERNEL OIL.—Crude, f.m.q., spot, £22 per ton, naked. GROUNDNUT OIL.—Crushed/extracted, spot, £25 10s.; deodorised, spot, £20 10s. per ton. SOYA OIL.—Extracted, spot, and crushed, spot, £19; deodorised, spot, £22 10s. per ton. RAPE OIL.—Crushed-extracted, spot, £26 10s.; refined, spot, £28 10s. per ton. COD OIL.—Spot, 18s. per cwt. TURPENTINE.—Spot unquoted.

South Wales By-Products

THERE is scarcely any change in South Wales by-product activities. Business generally is slow and uncertain. Pitch continues to have a sporadic demand, with most of the business transacted being confined to small, prompt parcels. There is no change in values. Road tar has a slightly better call, with values unchanged round about 13s. per 40-gallon barrel. Refined tars are not so good, but values for coke-oven and gas-works tar are unchanged. Naphthas have a poor market, the call for solvent being slow, while heavy has practically no demand. Patent fuel and coke exports continue to be very unsatisfactory. Patent fuel prices for export, are :—19s. to 19s. 9d., ex-ship Cardiff; 19s. to 19s. 6d., ex-ship Swansea, Coke prices are :—Best foundry, 32s. 6d. to 36s. 6d.; good foundry, 22s. 6d. to 25s.; furnace, 16s. 6d. to 17s. 6d.

Scottish Coal Tar Products

CONDITIONS have been quiet in this area during the week, business being confined mainly to refined coal tar for road making. Water white products remain in very poor request with quotations easy, but creosote oils continue to hold their own.

Cresylic Acid.—With inquiries scarce, quotations are irregular. Pale, 99/100%, 1s. 5d. to 1s. 6d. per gallon; pale, 97/99%, 1s. 3d. to 1s. 4d. per gallon; dark, 97/99%, 1s. 2d. to 1s. 3d. per gallon; high boiling, 2s. 6d. to 3s. per gallon; all ex-makers' works in buyers' packages.

Carbolic Sixties.—The position is unchanged with value nominal at 1s. 2d. to 1s. 4d. per gallon according to quality.

Creosote Oil.—Buying continues in small but steady quantities. Specification oils, 2½d. to 3d. per gallon; washed oil, 3¼d. to 3½d. per gallon; gas works ordinary, 3½d. to 3¾d. per gallon; all f.o.r. works in bulk.

Coal Tar Pitch.—Offered at about 45s. to 47s. 6d. per ton, f.o.b. Glasgow, but orders are not too plentiful. Home value is 40s. to 42s. 6d. per ton, ex works.

Blast Furnace Pitch.—Stocks are gradually decreasing, but controlled prices are unchanged at 30s. per ton f.o.r. works for home trade, and 35s. per ton f.a.s. Glasgow for export.

Refined Coal Tar.—While new business is not too plentiful, deliveries "ex contract" are proceeding rapidly. Value is firm at 2½d. to 2¾d. per gallon f.o.r. in buyers' packages.

Blast Furnace Tar.—Remains dull at 2¾d. per gallon, f.o.r.

Crude Naphtha.—Available supplies are offered at 4¼d. to 5¼d. per gallon according to quality.

Water White Products.—Market is practically stagnant and prices are purely nominal. Motor benzole, 1s. 3½d. to 1s. 4½d. per gallon; 90/160 solvent, 1s. 2½d. to 1s. 3½d. per gallon; and 90/190 heavy solvent, 1s. 0½d. to 1s. 1½d. per gallon; all f.o.r. in bulk.

Price Reduction in Bismuth Salts

MAY AND BAKER, LTD., announce a reduction in the prices of bismuth salts by 1s. 6d. per lb. on carbonate and corresponding differences on other salts.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE *by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing this firm's independent and impartial opinions.*

Glasgow, September 22, 1931.

THE Scottish heavy chemical market still continues to show an improvement. No important change in price has taken place.

Industrial Chemicals

ACETONE.—B.G.S.—£60 to £63 per ton, ex wharf, according to quantity.

ACID, ACETIC.—Prices ruling are as follows: glacial, 98/100%, £45 to £56 per ton; pure, £35 5s. per ton; technical, 80%, £34 5s., delivered in minimum lots of 1 ton.

ACID, BORIC.—Granulated commercial, £22 per ton; crystals, £23 per ton; B.P. crystals, £31 per ton; B.P. powder, £32 per ton, in 1-cwt. bags, delivered Great Britain free in one-ton lots upwards.

ACID, HYDROCHLORIC.—Usual steady demand. Arsenical quality, 4s. per carboy. Dearsenicated quality, 5s. per carboy, ex works, full wagon loads.

ACID, NITRIC, 80° QUALITY.—£23 per ton, ex station, full truck loads.

ACID, OXALIC.—98/100%.—On offer at 3¼d. per lb., ex store. On offer from the Continent at 3¼d. per lb., ex wharf.

ACID, SULPHURIC.—£3 7s. 6d. per ton, ex works, for 144° quality, £5 15s. per ton for 168°. Dearsenicated quality, 20s. per ton extra.

ACID, TARTARIC, B.P. CRYSTALS.—Quoted 11d. per lb., less 5%, ex wharf. On offer for prompt delivery from the Continent at 10½d. per lb., less 5%, ex wharf.

ALUMINA SULPHATE.—Quoted round about £8 10s. per ton, ex store.

ALUM, LUMP POTASH.—Now quoted £8 10s. per ton., c.i.f. U.K. ports. Crystal meal, about 2s. 6d. per ton less.

AMMONIA ANHYDROUS.—Quoted 10½d. per lb., containers extra and returnable.

AMMONIA CARBONATE.—Lump quality quoted £36 per ton. Powdered, £38 per ton, packed in 5 cwt. casks, delivered U.K. stations or f.o.b. U.K. ports.

AMMONIA LIQUID, 80°.—Unchanged at about 2½d. to 3d. per lb., delivered, according to quantity.

AMMONIA MURIATE.—Grey galvanisers' crystals of British manufacture quoted £21 to £22 per ton, ex station. Fine white crystals offered from the Continent at about £17 5s. per ton, c.i.f. U.K. ports.

ANTIMONY OXIDE.—Spot material obtainable at round about £26 per ton, ex wharf. On offer for shipment from China at about £23 per ton, c.i.f. U.K.

ARSENIC, WHITE POWDERED.—Quoted £23 10s. per ton, ex wharf. Spot material still on offer at £24 per ton, ex store.

BARIUM CHLORIDE.—In good demand and price about £9 10s. per ton, c.i.f. U.K. ports. For Continental materials our price would be £8 10s. per ton, f.o.b. Antwerp or Rotterdam.

BLEACHING POWDER.—British manufacturers' contract price to consumers unchanged at £6 15s. per ton, delivered in minimum 4-ton lots. Continental now offered at about the same figure.

CALCIUM CHLORIDE.—Remains unchanged. British manufacturers' price, £4 15s. to £5 5s. per ton, according to quantity and point of delivery. Continental material on offer at £4 7s. 6d. per ton, c.i.f. U.K. ports.

COPPERAS, GREEN.—At about £3 15s. per ton, f.o.r. works, or £4 12s. 6d. per ton, f.o.b. U.K. ports.

FORMALDEHYDE, 40%.—Now quoted £29 per ton, ex store. Continental on offer at about £27 per ton, ex wharf.

GLAUBER SALTS.—English material quoted £4 10s. per ton, ex station. Continental on offer at about £3 per ton, ex wharf.

LEAD, RED.—Price now £30 per ton, delivered buyers' works.

LEAD, WHITE.—Quoted £38 per ton, carriage paid.

LEAD ACETATE.—White crystals quoted round about £32 to £34 per ton c.i.f. U.K. ports. Brown on offer at about £1 per ton less.

MAGNESITE, GROUND CALCINED.—Quoted £9 10s. per ton, ex store.

METHYLATED SPIRIT.—Industrial quality 64 o.p. quoted 2s. per gallon, less 2½% delivered.

POTASSIUM BICHROMATE.—Quoted 4½d. per lb., delivered U.K. or c.i.f. Irish ports, with an allowance for contracts.

POTASSIUM CARBONATE.—Spot material on offer, £23 10s. per ton ex store. Offered from the Continent at £22 10s. per ton, c.i.f. U.K. ports.

POTASSIUM CHLORATE, 99½/100% POWDER.—Quoted £26 15s. per ton ex store; crystals 30s. per ton extra.

POTASSIUM NITRATE.—Refined granulated quality quoted £20 17s. 6d. per ton, c.i.f. U.K. ports. Spot material on offer at about £20 10s. per ton ex store.

POTASSIUM PERMANGANATE B.P. CRYSTALS.—Quoted 5¼d. per lb., ex wharf.

POTASSIUM PRUSSIATE (YELLOW).—Spot material quoted 7d. per lb. ex store. Offered for prompt delivery from the Continent at about 6¾d. per lb. ex wharf.

SODA, CAUSTIC.—Powdered 98/99%, £17 10s. per ton in drums, £18 15s. in casks. Solid 76/77% £14 10s. per ton in drums, £14 12s. 6d. per ton for 70/72% in drums; all carriage paid buyer's station, minimum four-ton lots; for contracts 10s. per ton less.

SODIUM BICARBONATE.—Refined recrystallised, £10 10s. per ton, ex quay or station. M.W. quality 30s. per ton less.

SODIUM BICHROMATE.—Quoted 3½d. per lb., delivered buyer's premises, with concession for contracts.

SODIUM CARBONATE (SODA CRYSTALS).—£5 to £5 5s. per ton, ex quay or station; powdered or pea quality, 7s. 6d. per ton extra. Light soda ash, £7 13s. per ton, ex quay, minimum four-ton lots, with various reductions for contracts.

SODIUM HYPOSULPHITE.—Large crystals of English manufacture quoted £9 2s. 6d. per ton, ex station, minimum four-ton lots. Pea crystals on offer at £15 per ton, ex station, minimum four-ton lots.

SODIUM NITRATE.—Price not yet fixed.

SODIUM PRUSSIATE.—Quoted 5½d. per lb., ex store. On offer at 5d. per lb., ex wharf, to come forward.

SODIUM SULPHATE (SALTCAKE).—Price, 60s. per ton, ex works; 65s. per ton, delivered, for unground quality. Ground quality 2s. 6d. per ton extra.

SODIUM SULPHIDE.—Prices for home consumption: solid 61/62%, £10 per ton; broken, 60/62%, £11 per ton; crystals 30/32%, £8 2s. 6d. per ton, delivered buyers' works on contract, minimum four-ton lots. Special prices for some consumers. Spot material 5s. per ton extra.

SULPHUR.—Flowers, £12 per ton; roll, £10 10s. per ton; rock, £9 5s. per ton; ground American, £8 10s. per ton, ex store.

ZINC CHLORIDE 98%.—British material now offered at round about £18 10s. per ton, f.o.b. U.K. ports.

ZINC SULPHATE.—Quoted £11 per ton, ex wharf.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

The Chemical Market in Newfoundland

United Kingdom Obtains Larger Share of Business

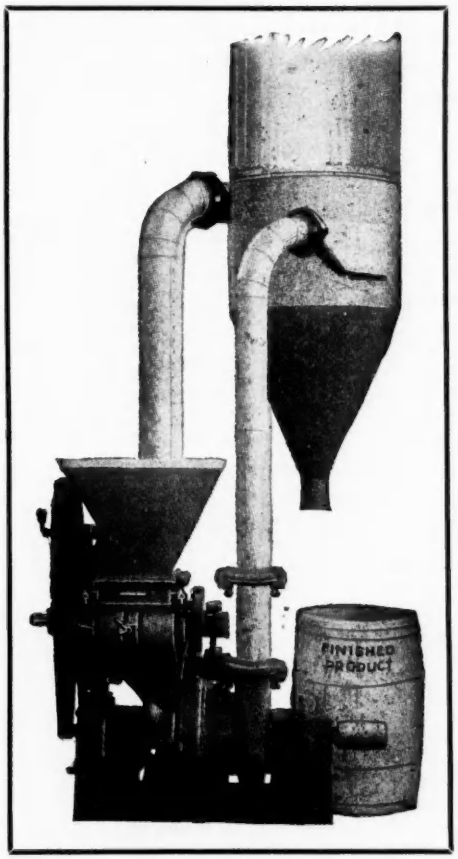
ACCORDING to a report on economic conditions in Newfoundland, which has just been published by the Department of Overseas Trade (H.M. Stationery Office, price 2s. net), the United Kingdom has been getting an increasing share of the business in chemicals, drugs, dyes and colours, but the United States and Canada still lead. The imports over the past four years averaged nearly half a million dollars yearly. The principal item in the group is "acetic acid, medicine, etc.," which amounted to over $320,000 in 1929-30, of which the United States supplied $145,000, Canada $130,000 and the United Kingdom $46,000. The next largest item is painters' colours, varnishes, putty, etc., the imports of which amounted to over $200,000, the United Kingdom obtaining more than 50 per cent. of the business. There is a paint manufacturing industry in St. John's. This firm buys all it possibly can in the way of colours and pigments in the United Kingdom, and is satisfied with its present sources of supply.

There is no doubt that a larger proprietary business could be developed with the United Kingdom if more active steps were taken by the producers to advertise their products. A complaint was made by a small jobbing concern with regard to castor oil. They stated that a Hull firm declined to furnish that commodity in ton parcels with the result that the importer went to France for this commodity. The tendency of the drug trade in Newfoundland is toward non-secret preparations, toilet requisites, etc., with the preference for United Kingdom goods, other things being equal. Some heavy chemicals, explosives, etc., are used by the mining companies and the pulp and paper companies. These are largely imported from Canada or the United States. The various cable companies and commercial garages use quantities of sulphuric acid for battery solutions; the Government (for its lighthouses), dry dock and railway uses some acetylene, oxygen, etc., all of which are obtained from Canada.

Alcohol Production Increases in Sweden

EIGHTEEN Swedish sulphite mills with plants for the production of alcohol from sulphite liquor produced 15,782,409 litres in 1930. Of this amount 7,660,997 litres were mixed with benzine as a motor fuel, 4,383,430 litres were denatured, and 1,134,709 litres were disposed of through beverage channels. The total 1930 output is 4,000,000 litres more than the 1929 figure and more than twice the 1928 production.

Dust danger eliminated with RAYMOND "OOOO" PULVERISER



In addition to this highly importan factor, especially when grinding materials injurious to health,

The RAYMOND PULVERISER

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very widely adaptable.

Its efficiency is established by the ever-increasing number of important manufacturers installing this pulveriser.

The Raymond is compact and easy to erect. No special attention is required during operation.

The Raymond will pulverise material containing more moisture than can be efficiently handled with any other kind of mill because of its air separation principle.

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HARDRAYMIL WESTCENT LONDON

Manchester Chemical Market

(From Our Own Correspondent.)

Manchester, September 24, 1931.

Cotton trade experts are seeing in the new monetary conditions a potential stimulant in the export branches of the trade. If this develops to any material extent the movement of a good many lines of chemical products will benefit. The chemical market this week has suffered from the uncertainties of the general situation, but at the moment of writing there is a spirit of hopefulness in evidence, and traders tend to look for some improvement in the demand. "Cuts" in acetate and nitrate of lead have been put into operation, but in most other respects, apart from minor fluctuations, the market has been reasonably steady.

Heavy Chemicals

The demand for bichromate of soda this week has been on moderate lines, with offers of this material well held on the basis of 3½d. per lb., less 1 to 2½ per cent., according to quantity. Chlorate of soda meets with a quiet call, with the price position unchanged at between £26 and £26 10s. per ton. Caustic soda maintains its firmness and a fair amount of business, much of it against existing contracts, is reported here; contract offers range from £12 15s. to £14 per ton, according to quality. Saltcake meets with a moderate inquiry, and parcels are on offer at about £2 15s. per ton. Bicarbonate of soda keeps up very well at round £10 10s. per ton, with buying interest in the material on moderate lines. No big weight of business is reported in the case of hyposulphite of soda, but quotations are reasonably steady at from £15 to £15 10s. per ton for the photographic quality and £9 5s. for the commercial. There has been no change in the position of prussiate of soda, a moderate business in which is passing at from 4¾d. to 5¼d. per lb., according to quantity. Little inquiry has developed this week in the case of sulphide of sodium, which is quoted at round £9 per ton for the 60-65 per cent. concentrated solid quality and £7 15s. for the commercial grade. Phosphate of soda has not moved appreciably, a quiet business being put through at about £10 per ton for the dibasic sort. Alkali is very firm and a fair demand is reported at £6 per ton.

On the whole, the potash products keep up fairly well. A quiet demand has been reported in respect of caustic, which is quoted to-day at round £27 10s. per ton. Not much interest is being shown in permanganate of potash, but values keep up at about 5d. per lb. for the commercial quality and 5¼d. for the B.P. Chlorate of potash is offering at from £27 to £27 10s. per ton, with current business in this section on rather humdrum lines. A quiet demand is about in the case of yellow prussiate of potash, which still ranges at from 6¾d. to 7¼d. per lb., according to quantity. Carbonate of potash is moving in moderate quantities, prices being on the easy side at about £23 15s. per ton. With regard to bichromate of potash, prices are steady on the basis of 4¼d. per lb., and the demand is moderate.

The undertone in the case of sulphate of copper during the past few days has been somewhat stronger in sympathy with the metal, prices ranging from about £18 to £18 10s. per ton, f.o.b. Arsenic is firm and still in comparatively short supply; values are in the region of £23 per ton at the mines for white powdered, Cornish makes. The demand for the lead compounds is on hand-to-mouth lines, and prices are easier at £27 10s. to £28 15s. per ton, according to quantity, for nitrate, with acetate at £29 2s. 6d. to £30 12s. 6d. for white and £28 17s. 6d. to £29 12s. 6d. for the brown quality. The acetates of lime are in quiet call, with values not too strong at up to £7 10s. per ton for the brown material and £12 for the grey.

Acids and Tar Products

There has been comparatively little change on balance in the price position of citric and tartaric acids, the movement of both being on a moderate scale at from 10d. to 10¼d. per lb. Oxalic acid moves off rather quietly, with prices steady at £1 14s. 6d. per cwt., ex store. Acetic acid is maintained at round £49 per ton for the technical glacial and £35 for the 80 per cent. commercial grade.

A fair call for pitch for export is reported, and values keep firm at about 52s. 6d. to 55s. per ton, f.o.b. Creosote oil is comparatively quiet still, but at 3d. to 4¼d. per gallon, naked, prices show little change. Solvent naphtha is only in moderate inquiry at the higher rate of 1s. 3½d. per gallon, naked. Crude carbolic acid is quoted at up to 1s. 3d. per gallon, for 60's, but sales are restricted; crystals are quoted at from 5¼d. to 5½d. per lb., f.o.b.

Company News

Bede Metal and Chemical Co.—The directors announce that the result of the operations for the first six months of the present year do not permit the payment of an interim dividend. A year ago an interim dividend of 6¼ per cent. was paid.

Taylors (Cash Chemists), London, Ltd.—It is announced that the directors have decided to postpone the consideration of the payment of the final dividend on the preference shares due on September 30, until they have had an opportunity of considering the accounts for the current year ending on October 3.

Lafarge Aluminous Cement.—The profit for the year ended March 31, 1931, was £14,545. The directors recommend taking £5,000 to create special reserve against sum deposited with Halifax Harbour Commissioners until 1942 as guarantee, and that sum of £1,308 to write down value of other freehold and leasehold property, and that the balance of £8,238 be carried forward in reduction of debit balance on profit and loss.

Amalgamated Zinc (de Bavays).—The report for the half-year to June 30, 1931, states that the balance credit appropriation account at the end of December last was £8,268, from which dividend 48 was paid, leaving the balance of £268. The income for the half-year was £6,831, consisting of £6,456 interest earned and £375 dividends received from shares in other companies. After deducting administration and other expenses, including £613 Broken Hill workers' compensation and £1,160 taxation provision, the net profit was £3,497. Since the close of the period dividend 49, absorbing £5,000 has been declared payable on October 8. The liquid assets show a surplus over liabilities of £220,011, not including £162,211 value of shares in other companies.

Chemical Trade Inquiries

These inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

South Africa.—The South African Railways and Harbours Administration is calling for tenders (Tender No. 1954), to be presented in Johannesburg by October 19, for the supply of approximately 23,800 lb. of tallow. (Ref. B.X. 7151.)

Holland.—A firm of agents in Amsterdam are desirous of securing the representation of British manufacturers of colours and other raw material, machines and apparatus for paint and varnish industry. (Ref. No. 276.)

France.—An agent at Bures-sur-Yvette (Seine and Oise) is desirous of representing a British firm for sugars and molasses. (Ref. No. 274.)

British India.—The Director-General, India Store Department, Belvedere Road, Lambeth, London, S.E.1, invites tenders for 70,000 gallons benzol (sample required with tender). Tenders are due October 6. Forms of tender obtainable from the above at a fee of 5s.

Permanent Pigment Colours

Emco Dyestuffs, Ltd., of Sculcoates, Hull, are well-known for the permanence of their colours, which are also uniform in quality. They claim to produce one of the finest ranges of pigment colours obtainable from British firms, including such colours as Permanent Red R, Permanent Red 4R, Permanent Red B, Permanent Red 2B, Permanent Red 4B, Permanent Red 2G, Permanent Yellow G, Permanent Yellow 5G, Permanent Yellow GR, Orange Y.O., Permanent Yellow R, Helio Bordeaux BL, Helio Fast Red RBL Extra, Lake Red C, Lake Red D, Lithol Red R and Pigment Green B. Adequate samples, prices and any further information will gladly be sent on request.

VITREOSIL CONTAINERS

Improvements in manufacture have made possible the production of containers or reaction vessels of large size. The picture shows one of 108 gallons capacity. It is 4 ft. 6 in. in height overall, and 2 ft. 6 in. internal body diameter.

THE THERMAL SYNDICATE LTD.

VITREOSIL WORKS, WALLSEND-ON-TYNE

LONDON DEPOT : THERMAL HOUSE, OLD PYE STREET, S.W.1

Lancashire and Cheshire Coal Research Association

New Research Laboratories Opened at Manchester

THE new research laboratories of the Lancashire and Cheshire Coal Association at Cheetham, Manchester, were formally opened on Tuesday, September 22, by Mr. R. A. Burrows in the presence of Professor J. S. Haldane and a large assembly of persons representative of the industry of mining engineering and of science.

The scientific investigations of the structure and composition of coal, with a view to its more efficient preparation for the market, has been vigorously pursued in Lancashire ever since the war ended. The Lancashire and Cheshire Coal Research Association, the first of its kind in the country, was formed by a number of coalowners of this coalfield under the presidency of Mr. R. A. Burrows and with Dr. F. S. Sinnatt, now Assistant Director of Research under the Department of Scientific and Industrial Research, but then a lecturer in fuels at the Manchester College of Technology. Very soon more than half the coal output of the two counties was represented in the association. Work was begun with a small staff in rooms at the College of Technology. Practical chemical research work was done in the analysis of coals, colliery water supplies, and lubricating oils; in the investigation of boiler and coal washing plants and the testing of washery appliances; and in the regular analysis of mine air and mine dust.

Pioneer Research Work on Coal

In 1928, however, the Association took over research in the microscopical examination of coal and the preparation of thin transparent sections of rocks and minerals, being aided in this development by a grant from the fuel research board established in 1917. This led to a comprehensive correlation of the coal seams of Lancashire. Much work has also been done on pyrites in connection with the origin of gob fires in coal mines. Owing to the pioneer research work already done by the Association, it was in Lancashire that the official Government survey of the coal seams of the country was begun, the Department of Scientific and Industrial Research using and supporting the organisation already existing here for the purpose. This work was enlarged and extended here from 1928 by the aid of an increased Government grant. A grant from the Safety in Mines Research Board has also allowed of the extension of the association's work on the spontaneous combustion of coal, and later the British Colliery Owners' Research Association followed the example of the Government in reorganising and financially helping the association's work. Among later problems under investigation are low-temperature carbonisation, hydrogenation, and other methods of industrial utilisation of coal. With these developments larger and better equipped laboratories therefore became a necessity, and a new three-floored fireproof building, not far from the centre of Manchester, was secured and has now been fitted up as offices and laboratories.

High Grade Plant for Tar Refining

COMPLETE tar dehydrating and distilling plants are made by the Leeds and Bradford Boiler Co., Ltd., of Stanningley. In the tar stills the tops and bottoms are pressed to shape by special hydraulic machinery, rivet holes are drilled in position, and all riveting where practicable is done by hydraulic machinery, which together ensure the highest possible class of tar still being made. Benzol stills, air receivers, condensing tanks, distillate tanks and storage tanks are other examples of the type of riveted steel plate and hydraulic press work undertaken.

Caustic Soda in Brazil

IMPORTS of caustic soda into Brazil during 1929 were 16,705 metric tons, compared with 21,734 tons in 1928. There were 7,216 tons imported for the first five months of 1930. During 1929 the imports from Great Britain were 12,454 tons and those from the United States, 4,033 tons. It is reported that only one manufacturer is now producing caustic soda in Brazil. The factors preventing development of the domestic industry are said to be technological difficulties and lack of market for by-product chlorine.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

BRITISH BYE-PRODUCTS, LTD., Lower Road, Northfleet, chemical manufacturers. (C.C., 26/9/31.) £18 13s. 4d. July 29.

B.M.B. (NITRO CELLULOSE) LACQUERS (a firm), Queen Street, Croydon, cellulose manufacturers. (C.C., 26/9/31.) £28 3s. 1d. August 18.

PAULTON, J. H. (male), 33, Whitehead Road, Aston (trading as X ACID LABORATORIES), manufacturer. (C.C., 26/9/31.) £14 2s. 6d. June 9.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]*

HAZLEWOOD AND SONS, LTD., Patricroft, chemical manufacturers. (M., 26/9/31.) Registered September 9, debenture securing to Mosley Street Nominees, Ltd., 38, Mosley Street, Manchester, all moneys due or to become due to Williams Deacon's Bank, Ltd.; general charge. *Nil. January 16, 1931.

Satisfaction

NEWCASTLE-UPON-TYNE ZINC OXIDE CO., LTD. (M.S., 26/9/31.) Satisfaction registered September 14, £12,000, registered February 14, May 9, and December 2, 1930.

London Gazette, &c.

Company Winding Up Voluntarily

STANDARD AMMONIA COMPANY OF SYDNEY, LTD. (C.W.U.V., 26/9/31.) By special resolution, September 16.

New Companies Registered

F.O.C., LTD., 7, Baldwin Gardens, London, W.C.—Registered September 17. Nominal capital, £100 in 1s. shares. Research chemists, mechanical, consulting and experimental engineers of all kinds, etc. Directors: E. B. Cohn and G. S Oxenford.

E. E. FLETCHER, LTD. Registered September 21. Nominal capital £300, in £1 shares. Bullion dealers, refiners, assayers, metallurgists, chemists, engineers and samplers, etc. Directors: E. E. Fletcher, 137, Gloucester Road, Tottenham, London, N.15; T. Chopping, D. C. Knight, E. S. Zucca.

WESTERN OXIDE AND PAINT CO., LTD.—Registered September 16. Nominal capital, £4,000 in £1 shares. Paint manufacturers and dealers, smelters of zinc spelter, manufacturers of zinc oxide, grinders of minerals and other materials for paints, manufacturers of and dealers in white lead and varnishes, etc., to acquire the paint factory with the machinery and fixtures therein and the buildings adjoining at Beech Avenue, Plymouth, occupied by the Western Pigment Co., Ltd., and to acquire or take on lease certain premises known as South View, Callington, Cornwall, comprising a factory, furnaces and 10 acres of land, and all machinery and plant therein. The provisional directors are: Mrs. M. C. Davy, 5, Osborne Place, Plymouth, C. L. Croft, A. H. Blight, and G. F. Phillips.